BULLETIN

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EDITOR, J. A. ALLEN.

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GENERA AND SUBGENERA.

SPECIES AND SUBSPECIES.

ERRATA.

Page 143, Fig. 1, for *Globiosoma* read *Gobiosoma.*
" 147, line 19, for *brevirostris* read *rubrirostris.*
" 293, Fig. 27, for *Diadodexis* read *Diacodexis.*
" 354, line 3, for *Neotoma mexicanofallax* read *Neotoma mexicana fallax.*
" 354, " 5, for *Ocinerea rolestes* read *cinerea orolestes.*
" 507, " 19 from bottom, for *Telconemia belfragei* read *Teleonemia belfragei.*
" 532, lines 17, 19, 22 and 25, for *Dræculacephala* read *Dræculocephala.*
" 588, line 16, for 8500 ft. read 3500 ft.
" 593, lines 18 and 32, for Rio Caura read Rio Cesar.

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American Museum of Natural History.

Volume XXXIII, 1914.

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Article I.— THE ANTS OF HAITI.[1]

By W. M. Wheeler and W. M. Mann.

The following paper is based on a large series of Formicidæ taken in the republic of Haiti by the junior author during the winter of 1912–'13, while he was collecting zoölogical specimens for the Museum of Comparative Zoölogy and Mr. B. Preston Clark of Boston. Although San Domingo was not visited, it seemed desirable to enumerate also the few species known from that country as well as all previous records from Haiti proper. As the naturalist is apt to encounter peculiar obstacles in carrying on work in the island, the junior author wishes to express his appreciation of the kindness of a number of gentlemen who assisted him in obtaining transportation, letters of introduction and living accommodations. M. Tancrède Auguste, the late president of Haiti, gave him general permission to travel throughout the republic, and Archbishop Conan kindly furnished him with letters to the priests of his diocese, the only gentlemen with whom it was possible at times to secure lodgings. Father Plomby of Furcy, Father Braun of Grande Rivière and the Abbé Meliande of Milot befriended and lodged him, not only once but on several occasions. Mr. Willoughby, chief engineer of the American railroad now being built through Haiti, looked after his welfare in the construction camps, as did also Messrs. Wilkinson and Shea in the northern part of the republic. Dr. John B. Terres welcomed him in his home at Diquini, a short distance to the west of Port au Prince. This was an ideal spot for collecting and the genial doctor himself took a personal interest in the work and collected many desirable specimens. The junior

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 72.

author also passed several days on the enormous sugar plantation at Momance, as the guest of its owner, Gen. J. F. Jeffrard. In the north, headquarters were made at Charmette, near Cape Haitien, in the home of an American, Mr. W. M. Kirchner, who is engaged in growing cotton. Dr. Henry Furniss, United States minister to Haiti, gave much useful advice and assistance, and Messrs. Moore and Furbush of the American legation, Messrs. Baptiste and Livingston of the Consular service, Mr. J. H. Allen of the National Bank, Mr. Johnson of Jacmel, Capt. Gatchal of Port au Prince, and, in fact, all the members of the American colony greatly facilitated traveling and residence and were of material assistance in many other ways.

The following is a list of some of the localities cited for the various species enumerated in the following paper, with notes on their peculiarities: —

Diquini. The residence of Dr. John B. Terres, United States Consul General, near Bizaton, west of Port au Prince and among low hills. Cultivated ground and open woods along a stream made this a rich field for the collector.

Momance. The sugar-cane plantation of Gen. Jeffrard, on the railroad between Port au Prince and Laogane; flat, cultivated country, a little above sea-level.

Manneville. On the west shore of Lake Assuei; hot and dry, with desert vegetation, such as cacti and thorny bushes; with a few small, sporadic, cultivated tracts. This locality is scarcely above sea level.

Petionville (*Le Coup*). The summer resort of Port au Prince; about three miles inland and at an altitude of about 500 m. Most of the collecting here was in shady ravines and on the hill slopes back of the town.

Furcy. A small settlement in the high mountains south of Port au Prince, at an altitude of 1730 m.[1] Collecting here was mostly along the mountain ridge or in the cañons on each side. Owing to the altitude the climate is delightful, though the nights are rather too cool for comfort. There is a curious intermingling of tropical and temperate vegetation, pine trees growing with coffee-plants and bananas among patches of Indian corn. Numerous insects seemed to be peculiar to this region, notably *Macromischa sallei* subsp. *haytiana* which was taken only here and as the commonest insect. It is not improbable that each of the mountain ranges of Haiti has its own faunal peculiarities.

Mountains north of Jacmel. A region on the eastern fork of the river

[1] The altitude of Furcy is stated variously by different authors. Lĕger (Haiti, Her History and Her Detractors. Neale Pub. Co., New York and Washington, 1907, p. 275) gives it as 1,540 meters. A map in the presbytère of the chapel at Furcy had it marked 1,730 m.

which flows southward and enters the sea at Jacmel. The exact location of the collection cannot be given, but, roughly speaking, it was along the river about a ten hours' horse-back journey from Jacmel.

Cape Haitien. Collections mostly from Charmette, the plantation of Mr. Kirchner, some three miles southeast of the town.

Grande Rivière. A few miles beyond the town on the right of way of the railroad now under construction at the camps of Messrs. Wilkinson and Shea.

Milot. On the trail between Milot and the citadel of Christophe.

Up to the present time our knowledge of the ants of Haiti has remained very meager. Latreille, Guérin, Frederick Smith and Roger long ago described a few species from San Domingo, and more recently Emery and Forel have recorded several others from a few specimens taken by various collectors in Haiti. Altogether, however, not more than two dozen forms have been recorded from the whole island. In the present paper 90 forms are recognized, 37 of which are described as new to science. The whole series may be divided into three groups: those known only from the island of Haiti, those common to other West Indian Islands and the adjacent tropical mainland (Central and South America) and those which are tropicopolitan and therefore, in all probability, introduced by commerce. The following 47 or 52.2% of all the forms are known only from the republic of Haiti and San Domingo:

Platythyrea strenua
Emeryella schmitti
Spaniopone haytiana
Trachymesopus rufescens
Lobopelta antillana
Stenomyrmex haytianus
Odontomachus paucidens
Pseudomyrma haytiana
" affinis
" torquata
" subatra
Solenopsis inermiceps
Pheidole terresi
" illota
" haytiana
" creola
Aphænogaster relicta
" epinotalis
Ephebomyrmex schmitti
" sublævigatus
" saucius
Macromischa sallei
" haytiana
" flavidula
Cryptocerus hæmorrhoidalis
" marginatus
Trachymyrmex haytianus
Iridomyrmex keiteli
" flavescens
" subfasciatus
Tapinoma opacum
Rhizomyrma parvidens
" dubitata
Camponotus plombyi
" haytianus
" fraterculus
" soulouquei
" illitus
" imbecillus
" larvigerus
" ulysses
" sublautus
" furnissi
" occultus
" christophei
" augustei
" toussainti

The forms common to other West Indian Islands or to the tropical mainland are 34 in number and constitute 37.7 % of the whole known ant fauna:

Platythyrea punctata
Trachymesopus stigma
Ponera opaciceps
" ergatandria
Leptogenys puncticeps
Anochetus mayri
Odontomachus haematoda
" insularis
Pseudomyrma delicatula
" cubaënsis
Cardiocondyla venustula
Solenopsis geminata
" globularia
" borinquenensis
" pollux
Crematogaster steinheili
Pheidole jelskii
Pheidole antillensis
" vincentensis
" jamaicensis
Wasmannia auropunctata
Strumigenys alberti
" rogeri
" unispinulosa
Trachymyrmex jamaicensis
Mycocepurus smithi
Cyphomyrmex minutus
Dorymyrmex niger
Brachymyrmex heeri
Nylanderia itinerans
" steinheili
" fulva
Camponotus ustus
" sexguttatus

Only 9 forms or 10 % belong to the tropicopolitan group:

Monomorium salomonis
Monomorium floricola
" ebeninum
Pheidole megacephala
Tetramorium guineense
Tetrogmus simillimus
Tapinoma melanocephalum
Nylanderia longicornis
" hagemanni

For the sake of comparing the three groups of forms recorded above with the corresponding groups in the other Great Antilles, Cuba, Jamaica and Porto Rico (including the Virgin Islands), the following table has been compiled from former papers by the senior author:

Greater Antilles	Forms peculiar to each Island.	Forms common to other Antilles or Mainland.	Tropicopolitan ("tramp") species	Total number of forms
Cuba	34(43.1%)	37(46.8%)	8(10.1%)	79
Haiti	47(52.2%)	34(37.7%)	9(10.%)	90
Jamaica	17(26.9%)	37(58.7%)	9(14.3%)	63
Porto Rico	14(22.2%)	39(61.9%)	10(15.8%)	63

It will be seen from this table that the number of species, subspecies and varieties of ants is less in the two smaller than in the two larger Great Antilles, though greater in Haiti than Cuba, that each of the islands has 8–10

tropicopolitan "tramp" species and that the number of widely distributed neotropical forms is nearly the same in all the islands, varying only from 34–39.[1]

The greatest interest attaches to the forms peculiar to each island. These, which vary considerably, from only 15 and 17 on Porto Rico and Jamaica to 34 and 47 on Cuba and Haiti, comprise species, subspecies and varieties, and most of the subspecies and varieties represent merely local races of species which occur elsewhere in tropical America. An enumeration of the species peculiar to each island gives a different proportion, Cuba having 21, Haiti 19, Jamaica 9 and Porto Rico 7 species, which are known to occur in no other part of the world. These may, therefore, be regarded as truly indigenous forms or relicts of some ancient fauna, whereas the subspecies and varieties peculiar to each island are presumably, in great part at least, of more recent development. The latter may therefore be called "recently indigenous," the former "primitively indigenous" forms, whereas those which are common to two or more of the Antilles or to Central or South America, may be designated as "widely ranging." It is evident, however, that this can be only a rough classification since some of the widely ranging forms may have been quite as long on the islands as some of the recently or even primitively indigenous forms, but may belong to very stable species, which have undergone very little or no modification in response to differences of geographical environment.

It is certain, nevertheless, that what we have called the primitively indigenous forms are the most distinctive and striking component in the ant-fauna of each island. In Haiti this component, as previously stated, comprises 19 species. Two of these, *Emeryella schmitti* and *Spaniopone haytiana,* also represent genera peculiar to the island. The only other Antille known to have a peculiar genus (*Nesomyrmex*) is Grenada. Both *Emeryella* and *Spaniopone* belong to the Ponerinæ, the most primitive of the five subfamilies of Formicidæ, the former allied to the neotropical subgenus *Gnamptogenys* of the genus *Ectatomma,* the latter allied to *Proceratium* and *Sysphincta,* but more primitive and more like the extinct *Bradoponera* of the Baltic amber and *Discothyrea,* a small and evidently very ancient genus, with discontinuous distribution (Central America, New Guinea). Three other Ponerinæ, *Platythyrea strenua, Lobopelta antillana* and *Stenomyrmex haytianus* are also confined to Haiti. In addition to these there is a peculiar *Solenopsis* (*S. inermiceps*), two species of *Ephebomyrmex* (*E. schmitti* and

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[1] Since the publication of the senior author's paper on the Ants of Cuba, Bull. Mus. Comp. Zoöl., LIV, 1913, pp. 477–505, two additional forms have been found among material from the island, namely *Crematogaster victima* F. Smith subsp. *steinheili* Forel and *Monomorium destructor* Jerdon.

saucius), a subgenus of *Pogonomyrmex*, a peculiar *Aphænogaster* (*A. relicta*), two species of *Macromischa* (*M. sallei* and *flavidula*), an aberrant *Cryptocerus* (*C. hæmorrhoidalis*), a distinct *Iridomyrmex* (*I. keiteli*), a *Tapinoma* (*T. opacum*) and two extraordinary species of *Camponotus* (*C. christophei* and *toussainti*). *Pogonomyrmex*, a genus well-represented in the Western United States, Mexico, Guatemala, Eastern Brazil and western and southern South America, occurs no where else in the West Indies. *Camponotus christophei* and *toussainti* are closely allied to a very peculiar species (*C. saussurei*) known only from St. Thomas. Another striking peculiarity of the Haitian fauna is displayed in the great development of forms belonging to the *C. maculatus* group. This is very poorly represented in Cuba, Jamaica and Porto Rico. Affinities of the Haitian with the Cuban and Porto Rican ant-faunas are indicated by the species of *Macromischa*, a genus best represented in Cuba (with nine species), but not known to occur in Jamaica, though represented by a few species in Mexico, Texas and the Bahamas. On the other hand, special affinities with the Jamaican fauna are indicated only by *Trachymyrmex jamaicensis*, which is also found in the Bahamas, but is not known to occur in Cuba.

Subfamily Ponerinæ.

1. **Platythyrea strenua** sp. nov. (Fig. 1.)

Worker. Length 8–8.5 mm.

Body rather stout. Head subrectangular, excluding the mandibles less than $1\frac{1}{3}$ times as long as broad, with very feebly convex sides and very feebly concave pos-

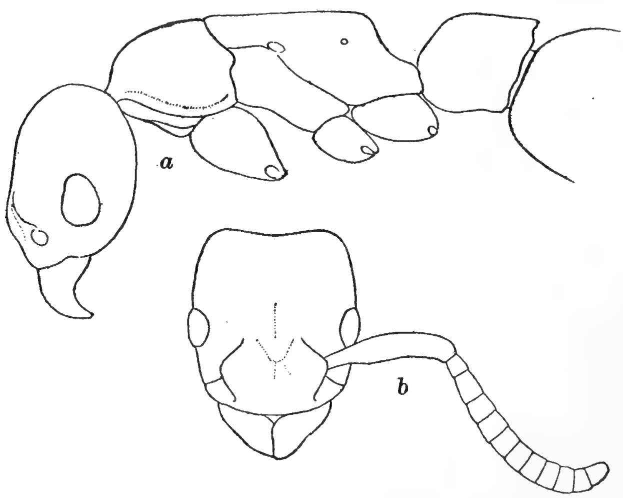

Fig. 1. *Platythyrea strenua* sp. nov. Worker. a, profile of head, thorax and petiole; b, head of same from above.

terior border. Eyes rather large and flat, nearly as long as their distance from the anterior border of the head and a little in front of the middle of its sides. Mandibles edentate, rather flat, their external borders very feebly concave near the tips. Clypeus flat, with broadly rounded anterior border, and indistinct posterior suture. Frontal area and frontal groove distinct, the former elliptical, about twice as long as broad. External borders of the flattened frontal carinæ bluntly angular. Antennal scapes reaching to the posterior corners of the head; second and terminal funicular joints longer than broad, remaining joints as broad as long. Thorax unarmed, narrower than the head, broader in front than behind, with flattened sides and dorsal surface, so that the latter appears submarginate laterally. Epinotal declivity concave, forming a distinct angle in profile with the base and surrounded on the sides and above with a distinct ridge. Petiole subcuboidal, from above but little longer than broad, as broad in front as behind, but narrower than the epinotum, its posterior border above and in the middle but slightly and very bluntly produced backward and very feebly, sinuately excised on each side. Gaster nearly twice as broad as the petiole, its first segment a little broader than long, the second as long as broad. Legs rather stout.

Body and appendages opaque, very finely and densely punctate, gaster slightly shining, sides of first gastric segment, mandibles and cheeks also with slightly larger, but by no means coarse punctures.

Hairs lacking, except on the tips of the mandibles and gaster and on the palpi, where they are very short. Pubescence very fine, yellowish gray, covering the body and its appendages with a uniform bloom.

Black; mandibles, clypeus, frontal carinæ, antennæ, tarsi and articulations of legs tinged with dull red; terminal gastric segments pale red.

Described from several workers taken at Diquini, from a rotten log, in close proximity to a termite colony.

This is clearly distinct from any of the five known neotropical species of *Platythyrea.* It is larger and more robust than *punctata* Smith, *meinerti* Forel and *angusta* Forel, darker in color than *meinerti,* which is brown and differs also in the shape of the petiole. *P. strenua* is also peculiar in lacking the coarse punctuation of *angusta* and *punctata.* From *sinuata* Roger it differs in lacking the mandibular teeth and from *incerta* Emery, which it resembles in size and in its more robust stature, it may be distinguished by the absence of coarse punctures on the head and mandibles, by the smaller frontal carinæ, the more distinct frontal groove, etc.

2. **Platythyrea punctata** F. Smith.

Catalog. Hymen. Brit. Mus. VI, 1858, p. 108 ☿ ♂.

This species was originally described from San Domingo, but has since been found to be widely distributed through the West Indies, Central and northern South America. The junior author has taken it at Cape Haitien, Grande Rivière and Milot, running about on the ground in shady places.

3. **Emeryella schmitti** *Forel.* (Figs. 2 and 3.)

Ann. Soc. Ent. Belg., XLV, 1901, p. 334, ☿.

Worker. Length 7–9 mm.

Head large, subrectangular, broader than long, broader in front than behind, with rather straight sides and feebly excised posterior border. Eyes moderately large, at the middle of the sides of the head. Mandibles longer than the head, inserted far apart at its anterior corners, sublinear and curved, somewhat broader at the base, obliquely truncated at the tip, with a large, blunt, triangular tooth at

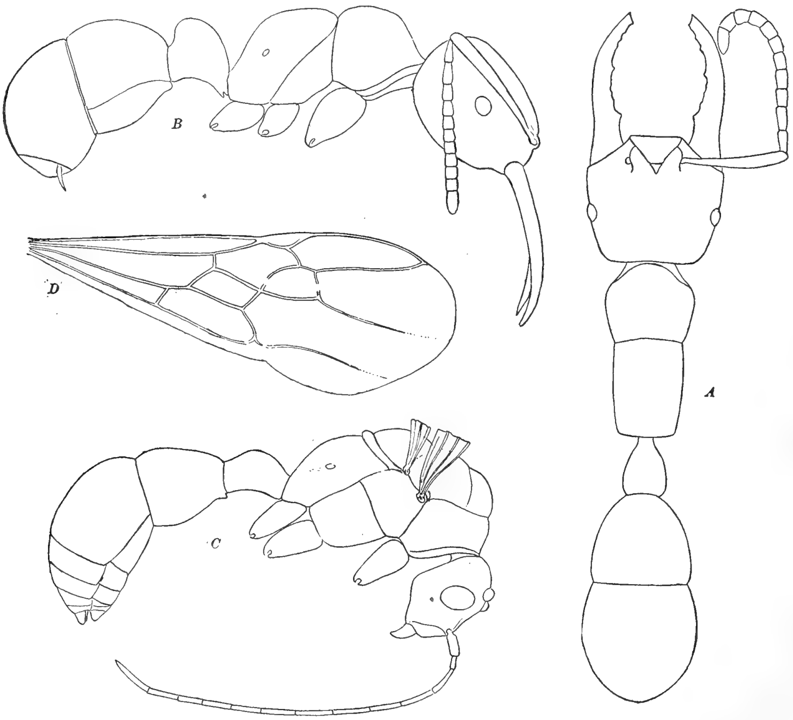

Fig. 2. *Emeryella schmitti* Forel. A, dorsal view of worker; B, profile of worker; C, profile of male; D, wing of male.

the basal third and a few indistinct, widely separated denticles on the most distal portion of the internal border. Clypeus very short, its anterior border in the middle straight, excised on the sides at the insertions of the mandibles, its median surface rather flat. Frontal carinæ very short, about as far apart as each is from the lateral border of the head. Frontal area distinct, triangular. Antennal scapes slightly curved, their tips extending a short distance beyond the posterior corners of the head; funicular joints 1–4 distinctly longer than broad, the second longest; joints 5–10 scarcely longer than broad, terminal joint as long as the two preceding taken together. Thorax short and robust, much narrower than the head, broadest

through the pronotum which has rounded, convex sides and dorsum. Promesonotal suture deep. Meso- and epinotum not separated by a suture, together but little longer than the pronotum including the neck. The base of the epinotum, which is unarmed, straight above in profile and passing into the concave or flattened declivity through a rounded angle. Petiole longer than broad, narrower in front than behind, about as long as high, in profile rounded and convex above, with a more abrupt posterior declivity to the node; ventrally with a small tooth at its anterior border. Gaster more than twice as broad as the petiole, short, its first segment campanulate, as broad as long, with a strong tooth on its anterior ventral border; second segment somewhat longer than broad, very convex dorsally, remaining segments small, telescoped into the second segment and directed forward. Sting small. Legs rather long.

Somewhat shining; mandibles coarsely and sparsely punctate; head and pronotum sharply longitudinally rugose; meso- and epinotum and petiolar node transversely rugose; first gastric segment in front with arcuate rugæ which enclose behind a space that is longitudinally rugose; second segment with much coarser and sharper rugæ converging at the anterior and posterior borders of the segment. Antennal scapes and legs covered with small piligerous punctures.

Hairs short, coarse, grayish, erect on the body, shorter and more reclinate on the appendages.

Black, with a slight reddish tinge, which is more pronounced on the mandibles, antennæ, tarsi and articulations of the legs; terminal segments of gaster paler red or brownish.

Male. Length 6–7 mm.

Head, including the mandibles, a little longer than broad, very convex and rounded behind, with large, convex eyes and ocelli. Clypeus moderately convex, with broadly and feebly excised anterior border. Frontal area distinct, triangular; frontal carinæ very small. Mandibles small, triangular, pointed, with a few distinct teeth on the base of their apical border. Antennæ very long; funicular joints 2–13 slender, cylindrical and subequal, first joint somewhat longer than broad, distinctly shorter than the third joint. Thorax rather short and robust, mesonotum with pronounced Mayrian furrows; epinotum sloping, rounded, unarmed, without distinct base or delivity. Petiole nearly twice as long as broad, scarcely narrower in front than behind, above with a very low, rounded node and below feebly concave in profile, with a minute tooth at its anterior end. Gaster similar to that of the worker, but the first and second segments more slender and the terminal segments more developed and not turned forward. First segment with a median longitudinal ridge on the dorsal side. Genitalia very small. Hypopygium minute, bluntly triangular. Cerci present. Legs long, and slender. Wings rather narrow.

Body shining. Mandibles, head and posterior portion of mesonotum punctate and finely, longitudinally striate. Surface of epinotum, petiole and first gastric segment uneven but scarcely rugose, the epinotum with coarse, scattered punctures. Second and following segments smooth and shining and like the legs, covered with minute piligerous punctures.

Hairs yellow, erect and abundant, both on the body and appendages.

Uniformly red; antennæ beyond the second joint fuscous; wings infuscated, with blackish veins and stigma.

Described from numerous workers and four males collected at Diquini

and Petionville.[1] Although the males were not taken in the nests but at lights, we believe there can be no doubt about their identity. The larvæ and pupæ taken from the nests are peculiar, the former resembling the larvæ of *Stigmatomma pallipes,* described many years ago by the senior author, in being very broad behind and very narrow and curved anteriorly and instead of being tuberculate, have the body covered with dense, soft, erect hairs. The pupae are enclosed in cocoons which are dark brown and singularly short and broad and obtuse at the ends.

This extraordinary ant, which both Forel and Emery believe to be most closely related to *Gnamptogenys,* a subgenus of *Ectatomma,* though the structure of the head bears a strange superficial resemblance to that of the

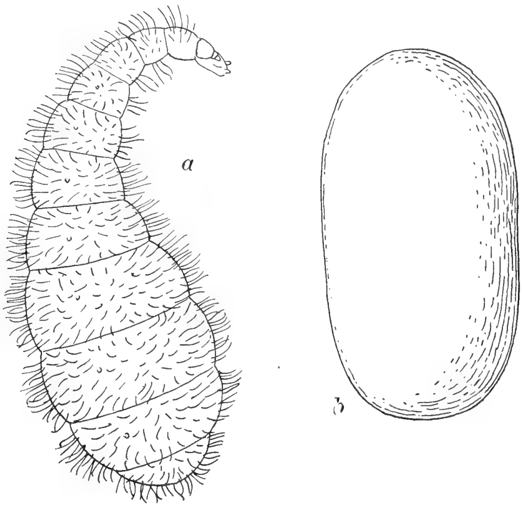

Fig. 3. *Emeryella schmitti* Forel. a, larva; b, pupa.

species of *Amblyopone, Stigmatomma* and *Mystrium,* has been known hitherto from only a single worker, which was sent to Forel by Rev. P. J. Schmitt, O. S. B. It is certainly a rare species even in Haiti and was found by the junior author only on three occasions. At Petionville a single worker was captured in a humid spot near a little stream. At Diquini, in a shaded place, also near a stream, two colonies were found, one under a stone and one by following up a worker that was out foraging in the late afternoon. This worker was carrying a Polydesmid Diplopod thrown over its body in such a manner that the ant was entirely concealed beneath its burden. The

[1] We have recently received several more males of *E. schmitti* from Dr. Terres, who took them at light at Diquini.

opening of the nest was circular and about $\frac{1}{4}$ of an inch in diameter, and led into a tunnel beneath a stone where some of the workers were gathered, though most of them, together with the larvæ and pupæ, were in chambers deeper in the earth, some six or seven inches below the surface. Scattered about in the nest were numerous fragments and several entire examples of a species of Polydesmid and of another Diplopod allied to our northern *Julus*. This fact, together with the behavior of the worker described above, indicates that *E. schmitti* feeds chiefly or entirely on Myriopods. The workers move slowly and deliberately like those of *Ectatomma tuberculatum* and *ruidum*. They seem to be very timid and secrete themselves when the nest is excavated. Probably they are crepuscular. The males are attracted to lights, all the specimens having been taken at night by Mr. J. B. Terres on the verandah of his house at Diquini.

Spaniopone gen. nov.

Worker. Allied to *Proceratium* Roger. Head shaped as in this genus, with minute eyes just behind the middle of its sides. Mandibles triangular, with indistinct denticles on their apical borders. Clypeus much larger than in *Proceratium*, with broadly rounded anterior border and its posterior border separated by a distinct suture from the front and cheeks and not wedged in between the frontal carinæ. These are well-developed but short, not covering the insertions of the antennæ, nearer together than each is from the side of the head, with feeble flattened lobes anteriorly and somewhat diverging posteriorly. Antennæ 12-jointed; scapes slightly enlarged but not incrassated at their tips; funiculi with a distinct 3-jointed club; first funicular joint longer than broad; joints 2–8 transverse but growing longer distally; joints 9 and 10 subequal, as long as broad and broader than the preceding joints; terminal as long as the three preceding joints together. Thorax shaped much as in *Proceratium*, but unarmed and with distinct pro-mesonotal and mesoëpinotal sutures. Petiole decidedly transverse, somewhat less squamiform than in *Proceratium*, the anterior surface being flattened; the upper rounded in profile and the posterior very short. First gastric segment fully as long and as large as the second, which is very convex above. Remaining segments small, forming a cone which is directed downward and forward. Tarsal claws simple; tibiæ with but a single spur.

4. **Spaniopone haytiana** sp. nov. (Fig. 4.)

Worker. Length 2.5 mm.

Head subrectangular, about $\frac{1}{3}$ again as long as broad, as broad in front as behind, with feebly convex sides and feebly and broadly excised posterior border. Mandibles with straight external and apical borders, the latter passing into the basal border through a distinct though rounded angle. Clypeus convex. Antennal scapes more than half as long as the funiculi, not reaching the posterior corners of the head. Pronotum with rounded humeri, rather flat above, somewhat broader than long, mesonotum twice as broad as long. Epinotum from above slightly broader than

long, in profile with the base short and passing rather abruptly through a rounded angle into the longer declivity. Petiole from above as broad as the epinotum, fully twice as broad as long, with rounded dorsal surface, subpedunculate in profile; its anterior slope is long and flattened, its summit rounded and its declivity very short. On the ventral side it bears a blunt tooth at its anterior border. First gastric segment as long as broad, with a small transverse swelling on its ventral surface near the anterior edge. Legs rather slender.

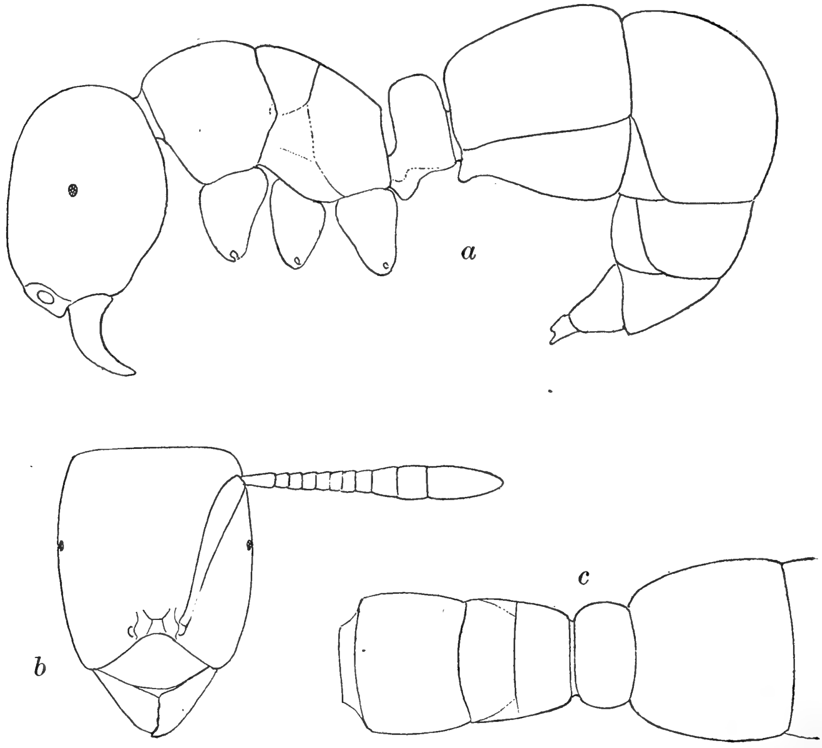

Fig. 4. *Spaniopone haytiana* sp. nov. Worker. a, profile; b, head from above; c, dorsal view of thorax, petiole and first segment of gaster.

Body opaque; mandibles, second and succeeding gastric segments shining; mandibles coarsely striato-punctate. Head delicately longitudinally rugulose; thorax, petiole and first gastric segment very finely punctate and indistinctly rugulose; first and second gastric segment very finely, transversely striated.

Hairs whitish, fine, rather abundant, suberect on the body, shorter and more appressed on the legs.

Color brownish yellow; mandibles slightly reddish, with black apical borders. The second and succeeding gastric segments and the legs slightly paler, the funiculi darker.

Described from a single specimen taken in the mountains north of Jacmel on a moist hill-side beneath a fallen banana stalk. It has been

necessary to erect a new genus for this singular ant, because it is obviously neither a *Proceratium* nor a *Sysphincta,* as shown by the structure of the clypeus, frontal carinæ, petiole and first gastric segment, the clubbed antennæ and the distinct thoracic sutures, though it is undoubtedly closely related to the first of these genera and must be included in the tribe Proceratini, as defined by Emery (Gen. Insect., Ponerinæ, p. 49). That it is a very primitive member of the group is indicated by the persistence of the thoracic sutures and the characters of the head, excepting the eyes. The reduction of these organs proves that it is hypogæic in habit like our northern species of *Proceratium* and *Sysphincta.*

5. **Euponera (Trachymesopus) stigma** *Fabr.*

Formica stigma Fabricius, Syst. Piez., 1804, p. 400. ☿.

Numerous workers and deälated females from Petionville, Manneville and Diquini. This ant is also recorded by Forel (Mitth. Naturh. Mus. Hamb. XXIV, Beiheft, 1907 p. 1) from St. Marc, Haiti.

6. **Euponera (Trachymesopus) stigma** *Fabr.* var. **rufescens** var. nov.

Worker. Differing from the worker of the typical form and the var. *attrita* Forel, in its smaller size and in coloration. It measures only 3.5–4.5 mm., and is red instead of black, with the top of the head in some specimens darker and more brownish.

Female (deälated). Indistinguishable in color, sculpture and size from the typical *stigma.*

Described from nine workers and a single female taken on the shore of Lake Assuei at Manneville. These were all from the same colony, which was nesting in the moist sand beneath a log. The workers cannot be immature as such individuals have a drab color in the typical *stigma.*

7. **Ponera opaciceps** *Mayr.*

Verh. zool. bot. Ges. Wien, XXXVIII, 1887, p. 536, ☿ ♀.

Numerous workers from Diquini, Grande Rivière and the mountains north of Jacmel.

8. **Ponera ergatandria** *Forel.*

Trans. Ent. Soc. London, 1893, p. 365, ☿ ♀ ♂.

Numerous workers from Ennery, Manneville, Grande Rivière and Diquini.

9. **Leptogenys puncticeps** *Emery.*

Ann. Soc. Ent. France (6), X, 1890, p. 62, *nota*, ☿.

Six workers and a male taken at Diquini and Grande Rivière agree closely with Emery's description of the types from Costa Rica and some workers taken by Prof. C. T. Brues in the island of Grenada. Forel described from St. Vincent a variety *vincentensis* which Emery (Gen. Insect. Ponerinæ, p. 100) refers to this species, but which Forel referred to *pubiceps* Emery (Rev. Suisse Zool., IX, 1901, p. 328). The nest of *L. puncticeps* at Diquini was in the ground, beneath débris, in an unused tobacco shed.

10. **Leptogenys (Lobopelta) antillana** sp. nov. (Fig. 5.)

Worker. Length 4.5–5.5 mm.

Body slender. Head about $1\frac{1}{3}$ times as long as broad, a little broader in front than behind, with rather straight sides and posterior border. Eyes small, shorter

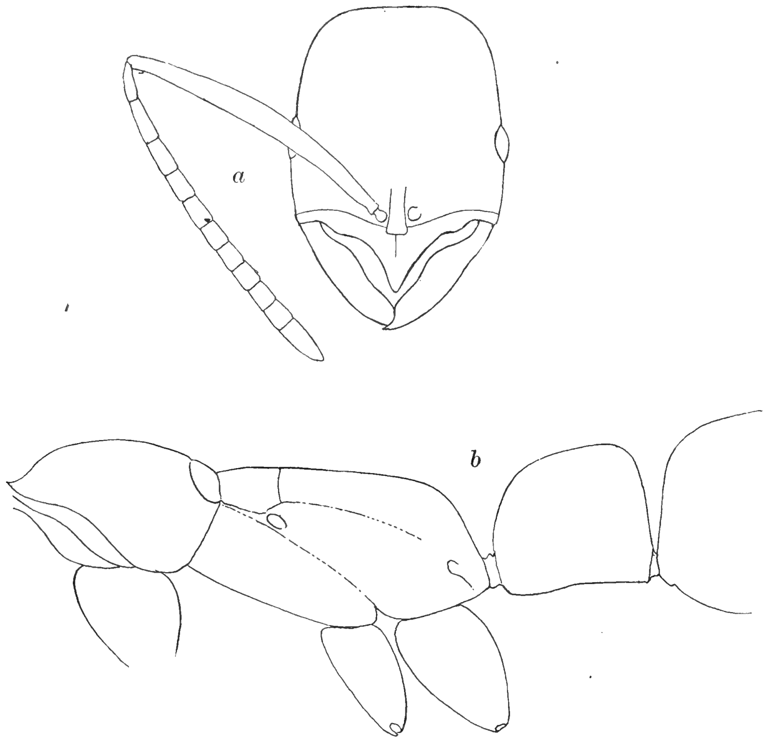

Fig. 5. *Leptogenys (Lobopelta) antillana* sp. nov. a, head of worker from above; b, thorax and petiole of worker in profile.

than their distance from the anterior corners of the head. Mandibles narrow but with distinct apical and basal borders. Clypeus very strongly carinate, with an anterior, median, beak-like point, filling the space between the mandibles when they are closed. Antennæ slender; scapes extending a little more than their greatest diameter beyond the posterior border of the head; funicular joints 1–5 decidedly longer than broad, the second longest, joints 6–10 only slightly longer than broad. Thorax in front as broad as the head, pronotum as broad as long, meso- and epinotum together longer than the pronotum, in profile with straight dorsal surface about twice as long as the declivity which is feebly convex. Petiole from above $1\frac{1}{2}$ times as long as broad, twice as broad behind as in front, the node laterally compressed, in profile as high as long, as high in front as behind, evenly rounded above, with short, abrupt, rounded anterior and posterior declivities. Gaster and legs slender.

Smooth and shining. Mandibles with a few coarse punctures along their internal borders.

Hairs whitish, short, suberect or reclinate, not very abundant on the body, more abundant and shorter on the scapes and legs.

Black; mandibles, funiculi, bases and tips of scapes, tarsi, knees, tips of tibiæ and tip of gaster red or reddish brown.

Described from seven specimens taken at Milot, Diquini and Petionville.

This species closely resembles *L. consanguinea* Wheeler of Mexico, but the mandibles are broader, with a distinct apical border, the petiole is of a very different shape, the antennal scapes are shorter and the pilosity is longer and more abundant.

11. **Anochetus mayri** *Emery.*

Emery, Ann. Mus. Civ. Genova, XXI, 1884, p. 378, ☿ ; Ann. Soc. Ent. France (6), X, 1890, p. 65, ☿ ♀.

Numerous workers and females from Manneville, Grande Rivière, Diquini, Milot and the mountains north of Jacmel.

12. **Anochetus (Stenomyrmex) haytianus** sp. nov. (Fig. 6 *d, e* and *f.*)

Worker. Length 6.5–7.5 mm.

Differing from *emarginatus* Fabr. in the following structural characters: The head is much broader behind, the mandibles shorter, with fewer (4 to 5) denticles on their inner borders and slightly shorter apical teeth. The antennal scapes and all the funicular joints are distinctly shorter, the former extending less than $\frac{1}{4}$ their length beyond the posterior corners of the head. The epinotum is quite unarmed, low and rounded in profile. The petiole is more erect, with subequal anterior and posterior declivities and at the summit with two teeth which are longer, more acute and more diverging than in *emarginatus.*

Body smooth and shining; pronotum finely and longitudinally, meso- and epinotum more coarsely and transversely rugose; front of head also finely longitudinally rugose, the rugæ diverging posteriorly.

Hairs very sparse as in *emarginatus* and confined to the mouth and gaster.

Color brownish yellow, legs, mandibles and antennæ paler, the tint throughout being lighter than in *emarginatus* subsp. *testaceus* Forel.

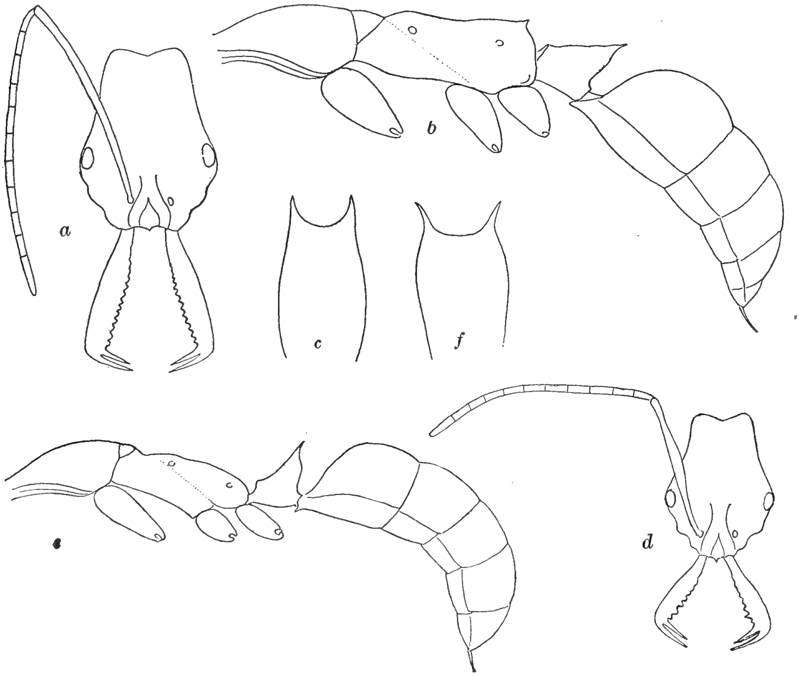

Fig. 6. a, head of *Anochetus* (*Stenomyrmex*) *emarginatus* (Fabr.) subsp. from Brazil, from above; b, body of same in profile; c, petiole of same from behind; d, head of *A.* (*S.*) *haytianus* sp. nov.; e, body of same in profile; f, petiole of same from behind.

Described from a number of specimens taken at Manneville and in the mountains north of Jacmel from small colonies nesting under stones in shady places.

This form is more than a mere subspecies of *emarginatus*, as all the various described subspecies of that form agree very closely with one another in their morphological characters.

13. **Odontomachus hæmatoda** *L.*

Formica hœmatoda Linné, Syst. Nat. Ed. X, 1758, p. 582, ☿.

This typical, large, dark form of the species is recorded by Forel from Port au Prince (Mitth. Naturh. Mus. Hamb., XXIV, 1907, Beiheft, p. 1 ☿ ♀).

A male and two small workers taken by the junior author at St. Marc and three workers from Manneville are referable to this form, which has 15–18 subequal denticles on the inner mandibular border.

14. **Odontomachus hæmatoda** *L.* var. **paucidens** *Emery.*

Ann. Soc. Ent. France, LXII, 1893, p. 91, *nota*, ☿.

The types of this variety came from Haiti, and it has also been recorded by Forel from St. Marc and Cape Haitien (Mitth. Naturh. Mus. Hamb., XXIV, 1907, Beiheft, p. 1, ☿). It has the same sculpture and color as the typical form but the mandibles are shorter and have only 10–12 denticles on the inner mandibular border and the subapical teeth are large. We refer to this form a large number of specimens taken at Grand Rivière, Manneville, Furcy, Ennery, Diquini, Port au Prince, Petionville, and the mountains north of Jacmel.

15. **Odontomachus hæmatoda** *L.* subsp. **insularis** *Guérin.*

O. insularis Guérin, Icon. Règne Animal. Ins., VII, 1845, p. 423, ☿.

This subspecies, which is common in Cuba, Florida and Georgia, has been recorded from Haiti by Emery, but is not represented among the specimens taken by the junior author.

Subfamily Myrmicinæ.

16. **Pseudomyrma flavidula** *F. Smith* var. **delicatula** *Forel.*

Ps. delicatula Forel, Biol. Centr. Amer., 1899–1900, p. 93, ☿ ♀.

Several workers from Cape Haitien and Port au Prince. In the latter locality a nest was found in a twig in the courtyard of the American Legation.

17. **Pseudomyrma championi** *Forel* subsp. **haytiana** *Forel.*

Ann. Soc. Ent. Belg., XLV, 1901, p. 342, ☿; Mitth. Naturh. Mus. Hamb., XXIV, 1907, Beiheft, p. 7.

The color of the worker of this variety is described by Forel as the same as that of the typical form, "but the antennæ are rather bright yellow and the legs blackish brown, with the tarsi and articulations yellowish. The second node of the pedicel has reddish spots. Another reddish spot is found

on each side behind the eye. The red of the thorax and first joint of the pedicel is quite as bright, though more opaque; there is a brown spot on the mesonotum and another on the declivity of the metanotum." The type specimens were received by Forel from Father Jerome Schmitt with the locality "Haiti." Other specimens were later received from Keitel who took them at Port au Prince. None of the specimens before us agrees closely with Forel's description of *haytiana*. They all seem to belong to two varieties which may be described as follows:

18. **Pseudomyrma championi** *Forel* subsp. **haytiana** *Forel* var. **affinis** var. nov.

The worker has the entire head, except its anterior border, black. The mesonotum has a black spot as described by Forel for the typical *haytiana*, but the epinotum has a narrow black streak down its middle and is somewhat infuscated on the sides. The petiole and postpetiole are black or dark brown, the former yellow at the base. The fore tibiæ are often entirely reddish yellow.

The female (deälated) measures 8 mm. and has the thorax, petiole and postpetiole reddish yellow, with a large black spot on the mesonotum, a smaller one on the scutellum, a black streak on the middle of the epinotum, two minute dusky spots on each side of the post-petiole and two small spots on the petiolar node.

Specimens of this variety were taken from several colonies in twigs at Diquini and Petionville. The female is from the former locality.

19. **Pseudomyrma championi** *Forel* subsp. **haytiana** *Forel* var. **torquata** var. nov.

The worker differs from that of the preceding form in having the petiole, postpetiole and thorax black, except the pronotum, which is yellowish red.

Numerous workers from Grande Rivière and Cape Haitien.

20. **Pseudomyrma elongata** *Mayr* var. **cubaënsis** *Forel.*

Mitth. Naturh. Mus. Hamb., XXIV, 1907, Beiheft, p. 7, ☿.

Several workers taken from hollow twigs at Grande Rivière and the mountains north of Jacmel closely resemble this common Cuban variety in their small size and the structure of the antennæ, head, petiole and thorax. This same variety is recorded by Forel from Cape Haitien (C. Gagzo).

21. **Pseudomyrma elongata** *Mayr* subsp. **subatra** subsp. nov.

Worker. Length 4–4.5 mm.

Differing from the typical *elongata* and the preceding variety in having the head somewhat shorter, the base of the epinotum shorter, more convex, and more rounded, so that it passes into the declivity with a much less distinct angle. The petiole and postpetiole are somewhat more slender, the former narrower behind, the latter slightly longer than broad. The surface of the body, behind the anterior portion of the head, much more shining, the punctures distinct but finer than in the other forms of *elongata* and the color much darker, being black, with the anterior portion of the head dark brown and the mandibles, clypeus and antennæ paler brown. The legs, including the tarsi, are black throughout.

Described from several workers taken at Diquini in the stems of bamboo. These specimens may represent a distinct species, but for the present we deem it best to regard them as having merely subspecific rank.

22. **Monomorium salomonis** *L.*

Formica salomonis Linné, Syst. Nat. ed 10, I, 1758, p. 580, ☿ .

Several workers and a deälated female of this well-known north African species were taken at Manneville from a large colony nesting beneath a stone in a very dry locality. The senior author has recorded it also from Nassau, New Providence Island, Bahamas. It has evidently been introduced into the West Indies by commerce, but seems to be spreading very slowly.

23. **Monomorium floricola** *Jerdon.*

Atta floricola Jerdon, Madras Journ. Lit. and Sci., XVII, 1851, p. 107, ☿ .

Several workers and females from Petionville.

24. **Monomorium carbonarium** *F. Smith* subsp. **ebeninum** *Forel.*

Monomorium carbonarium Forel, Mitth. Münch Ent. Ver., V, 1881, p. 8, ☿ .

Numerous workers and a female from Diquini, Manneville and Petionville.

25. **Cardiocondyla venustula** *Wheeler.*

Bull. Amer. Mus. Nat. Hist., XXIV, 1908, p. 128, ☿ ♀.

A single deälated female from the mountains north of Jacmel agrees very closely with the type female taken at San Juan, Porto Rico.

26. **Solenopsis geminata** *Fabr.*

Atta geminata Fabricius, Syst. Piez., 1804, p. 423, ♀.

Numerous workers of all sizes, together with males and females taken at Furcy, Cape Haitien, Manneville, and Diquini by the junior author and three workers taken in the San Francisco Mountains, San Domingo by Mr. Aug. Busck are all paler and more reddish than the common form in Cuba, Porto Rico and Jamaica and may represent a distinct variety. The species is also recorded from Port au Prince by Forel.

27. **Solenopsis globularia** *F. Smith.*

Myrmica (Monomorium) globularia F. Smith, Catalog. Hymen. Brit. Mus., VI, 1858, p. 131, ☿ ♀ ♂.

Recorded by Forel from Port au Prince.

28. **Solenopsis globularia** *F. Smith* var. **borinquenensis** *Wheeler.*

Bull. Amer. Mus. Nat. Hist., XXIV, 1908, p. 131, ☿.

Six workers from Manneville agree very closely with the types of this variety from Culebra Island.

29. **Solenopsis pollux** *Forel.*

Trans. Ent. Soc. London, 1893, p. 393, ☿ ♀ ♂.

Several workers from Cape Haitien and Manneville.

30. **Solenopsis inermiceps** sp. nov. (Fig. 7.)

Worker. Length nearly 2 mm.

Allied to *S. sulfurea* Roger. Head about $1\frac{1}{3}$ times as long as broad, subrectangular, with feebly convex sides and feebly and broadly excised posterior border. Eyes minute, at the anterior third of the head. Clypeus moderately convex, with broadly rounded anterior border, without longitudinal carinae or traces of teeth. Antennal scapes fully $\frac{2}{3}$ as long as the head; club large, as long as the remainder of the funiculus, its last joint 3 times as long as the penultimate; joints 3–7 slightly broader than long, first joint nearly as long as the four succeeding joints together. Mandibles oblique, with short teeth. Pro- and mesonotum robust, twice as long as the epinotum and $1\frac{1}{2}$ times as long as broad, moderately convex above and on the sides, separated from the epinotum by a strong suture and feeble impression. Epinotum small, a little longer than broad, its surface in profile sloping and feebly convex, without distinct base and declivity. Petiole with a slightly transverse, rounded node, which is a little narrower and higher than the postpetiole, with a small acute anteroventral tooth on the

peduncle. Postpetiole slightly broader than long, rounded. Gaster elongate elliptical, slightly narrowed in front. Legs rather slender.

Smooth and shining; the piligerous punctures scattered and extremely minute.

Hairs yellowish, erect, very sparse on the body; on the appendages shorter, denser and appressed.

Reddish yellow; head and thorax a little darker than the pedicel, gaster and appendages.

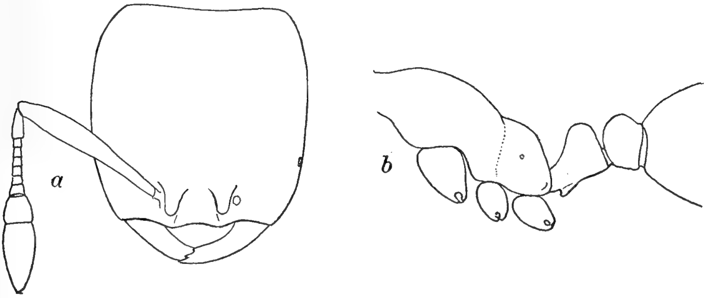

Fig. 7. *Solenopsis inermiceps* sp. nov. a, head of worker from above; b, profile of thorax and pedicel of worker.

Described from three workers taken at Petionville. A single specimen from Grande Rivière evidently belongs to the same species but is somewhat smaller (1.5 mm.). *S. inermiceps* is apparently very close to Roger's *S. sulfurea,* which was inadequately described. Emery has examined a cotype, however, and has figured the head (Bull. Soc. Ent. Ital., XXXVII, 1905, p. 136, fig. 17), which differs from that of *inermiceps* in having carinæ and very small teeth on the clypeus, in the outline of the head and the somewhat longer antennal scapes.

31. **Crematogaster victima** *F. Smith* var. **steinheili** *Forel.*

Cremastogaster steinheili Mitth. Münch. Ent. Ver., V, 1881, p. 15, ☿.

Several workers and a deälated female from Manneville and Port au Prince agree very closely with specimens of this variety from Kingston Jamaica, except in having the gaster somewhat darker brown.

32. **Pheidole fallax** *Mayr* subsp. **jelskii** *Mayr.*

Pheldole jelskii, Horæ Soc. Ent. Ross., XVIII, 1884, p. 34, ♃ ☿.

Recorded from Port au Prince by Forel.

33. **Pheidole fallax** *Mayr* subsp. **jelskii** Mayr var. **antillensis** *Forel.*

Ph. jelskii var. *antillensis* Forel, Ann. Soc. Ent. Belg., XLV, 1901, p. 365, ♃ ☿

All the specimens, comprising soldiers, workers and males, taken at Diquini, St. Marc, Grande Rivière, Manneville, Port au Prince and in the

mountains north of Jacmel, are properly referable to this variety, which is very common, nesting in the ground, usually in open, dry localities. Several large colonies were nesting in the courtyard of the American Legation at Port au Prince.

34. **Pheidole megacephala** *Fabricius.*

Formica megacephala FABRICIUS, Ent. Syst., II, 1793, p. 361, ♃.

Soldiers, workers and deälated females from Furcy, Milot and Diquini.

35. **Pheidole terresi** sp. nov.

Soldier: Length 2.3–2.6 mm.

Allied to *Ph. floridana* Emery. Head a little longer than broad, as broad in front as behind, with feebly convex sides, rather angular posterior corners and rather deeply and angularly excised posterior border. Occipital groove rather deep behind but disappearing anteriorly in the middle of the head, which is convex. Antennal sulci very feebly developed. Eyes rather small, at the anterior third of the head. Mandibles convex, with two apical teeth. Mentum with two prominent, acute teeth at its anterior border. Clypeus short, rather depressed, its anterior border feebly bidentate in the middle. Antennæ slender, scapes as long as half the distance from their insertions to the posterior corners of the head, joints 2–8 of the funiculus subequal, as long as broad, club as long as the remainder of the funiculus. Thorax robust, the pronotum nearly half as broad as the head, with prominent, angular humeri, separated by a distinct suture from the mesonotum which is small, abruptly sloping and with a transverse swelling. Mesoëpinotal constriction deep. Epinotum small and short, not longer than broad, in profile with the base a little shorter than the declivity, bearing two small, acute, erect teeth, which are decidedly shorter than their distance apart at the base. Petiole about $1\frac{1}{2}$ times as long as broad, with small but prominent anterior angles when seen from above broadest behind through the node, which is compressed anteroposteriorly, rather acute at the summit in profile and with its upper margin rather deeply notched when seen from behind. Postpetiole broader than long, somewhat broader than the petiole, with a very short, acute conule on each side a little in front of the middle. Gaster about as large as the head. Legs rather long, the femora and tibiæ not conspicuously swollen.

Shining throughout. Mandibles with coarse, scattered punctures. Clypeus smooth in the middle, longitudinally rugose on the sides. Head sharply longitudinally rugose on its anterior half, the interrugal spaces neither reticulate nor punctate and the rugæ absent behind on the antennal sulci, which are smooth and shining and not sharply defined laterally. Anteriorly these sulci are crossed by concentric rugæ running from the sides of the head to the frontal carinæ. The frontal rugæ diverge posteriorly and extend somewhat further back than those on the cheeks. The posterior portion of the head is glabrous, except for small, scattered, piligerous punctures. Thorax smooth, except the epinotum, which is subopaque, finely and rather superficially punctate-rugulose; pedicel, gaster, and legs smooth and shining, with fine, very sparse, piligerous punctures.

Hairs yellow, rather delicate, sparse, erect or suberect on the body, and anterior surfaces of the antennal scapes, a little shorter and more reclinate on the legs.

Mandibles, head, thorax and pedicel reddish yellow, remainder of body paler; borders of mandibles and clypeus broadly blackish or deep red.

Worker. Length 1–1.3 mm.

Closely resembling the soldier except in the head, which is small, smooth and shining and without rugæ, even on its anterior portion and cheeks. Antennal scapes extending a little beyond the posterior corners of the head. Pronotum longer and narrower and with rounded sides, not produced in the humeral region. Petiolar node with entire, rounded superior border, postpetiole as long as broad, rounded above and on the sides. Pilosity like that of the soldier but shorter and sparser. Color pale yellow throughout, except the borders of the mandibles and clypeus which are brownish.

Female (deälated). Length 4–4.5 mm.

Resembling the soldier. The head is broader and more nearly square, with rather straight sides and much less deeply excised posterior border. The rugæ are stronger and carried back nearly to the posterior corners. In other respects like the soldier, except for the usual morphological differences. The gaster is reddish yellow like the remainder of the body and the pilosity is somewhat more conspicuous. The wing insertions and thoracic sutures are blackish or dark brown.

Described from several soldiers and workers and two females taken from small colonies nesting in the ground in clay soil at Diquini and Milot.

This species belongs to the perplexing group of small neotropical forms including *Ph. floridana* Emery, *flavens* Roger, *anastasii* Emery, *punctatissima* Mayr, *goeldii* Forel and *mœrens* Wheeler, but differs from all of these at first sight in having the worker smooth and shining and not opaque and finely punctate. In this respect it resembles *Ph. dimidiata* Emery and *orbica* Forel, but differs from the former in the shape of the postpetiole, sculpture of the head, color, etc., from the latter in the longer antennal scapes, very different sculpture and color and very different pronotum, which is much broader and has much more prominent, angular humeri. The teeth on the epinotum are also much smaller and more acute than in *orbica.*

36. **Pheidole terresi** var. **illota** var. nov.

Soldier. Differing from the soldier of the typical *terresi* merely in having the dorsal surface more or less infuscated, the deeper color on the head being confined to the front, vertex and posterior corners.

Worker. Much darker than the soldier, the body being piceous or even blackish, with the mandibles, antennæ and legs yellow, the clypeus light brown.

Described from several soldiers and workers taken in the mountains north of Jacmel and at Furcy.

37. **Pheidole flavens** *Roger* var. **haytiana** *Forel.*

Mitth. Naturh. Mus. Hamb., XXIV, 1907, Beiheft, p. 6, ☿.

Soldier. Length 2.4–2.6 mm.

Differing from the soldier of the typical *flavens* Rog. of Cuba and the vars. *thomensis* Emery of St. Thomas and *vincentensis* Forel of St. Vincent in its sculpture, much darker color and in the shape of the epinotum. The latter has the base distinctly shorter than the declivity in profile. The head is more opaque and the longitudinal rugæ run back till they leave only the posterior fourth of the head smooth and shining, and the punctures and reticulation between the rugæ, especially on the antennal sulci, are more distinct. The head and pronotum are dull ferruginous, the remainder of the body dark brown or blackish, the antennal scapes and the femora more or less infuscated.

Worker. Length 1.5 mm.

Head and thorax dark brown or black; pedicel and gaster a little paler; antennæ, mandibles and legs yellow, the femora more or less infuscated in the middle. The base of the epinotum in profile is distinctly shorter than the declivity.

Female. Length 3.3–3.7 mm.

Thorax, pedicel and gaster black; head, including the mandibles, deep ferruginous, sometimes blackish behind. Antennæ and legs colored as in the soldier. Wings grayish hyaline, with pale brown veins and stigma.

Male. Length 3 mm.

Head blackish; thorax brown; remainder of body, including the sutures of the thorax, the antennæ, clypeus, mandibles and legs sordid yellow. Wings as in the female.

Described from numerous specimens taken from several colonies in the following localities: Petionville, Manneville, Diquini, and Grande Rivière. The nests are usually under bark. Forel has described only the worker of this variety from Port au Prince.

38. **Pheidole flavens** *Roger* var. **vincentensis** *Forel.*

Trans. Ent. Soc. London, 1893, pp. 411, ♃ ♀ ☿ ♂.

Several soldiers, workers and a single deälated female from Port au Prince, St. Marc, Grande Rivière and Petionville represent either this or a very closely allied variety of *flavens.* The soldiers and workers agree rather closely with cotypes of *vincentensis* Forel in the senior author's collection, except that the gaster in both phases is darker and in the female quite black. The Haitian specimens may, perhaps, be more properly regarded as representing a transition between the vars. *haytiana* and *vincentensis.*

39. **Pheidole punctatissima** *Mayr* var. **jamaicensis** *Wheeler.*

Several soldiers and workers and a single deälated female from Petionville. The female measures nearly 4.5 mm. and is black, with the antennæ,

mandibles, clypeus, front and cheeks ferruginous and the legs yellow, except the middle portions of the femora, which are black. The mesonotum is opaque and finely longitudinally rugose, with a median line and the parapsidal sutures smooth and shining.

40. **Pheidole mœrens** *Wheeler* subsp. **creola** subsp. nov.

Soldier. Length 2.3–2.5 mm.

Differing from the typical *mœrens* in the following particulars: the sculpture of the head is more extensive, leaving only the posterior corners shining. The longitudinal rugæ cover about $\frac{2}{3}$ of the head and behind them the surface is densely punctate, except the posterior corners which have only a few elongate, coarse punctures. The thorax is opaque and densely punctate throughout, the petiole and postpetiole punctate on the sides, with smooth and shining nodes. The color of the body is much darker, being black, with the antennæ, mandibles and clypeus, except their borders, red, the legs yellow, with the middle portions of the femora blackened, as are also the scapes.

Worker. Length 1–1.3 mm.

Closely resembling the worker of the typical *mœrens*, except in color, the pedicel and gaster being black, like the head and thorax, and the femora infuscated.

Described from several specimens taken at Diquini and in the mountains north of Jacmel. In the typical *mœrens* and in the var. *dominicensis* Wheeler from Dominica, the sculpture of the pronotum in the soldier is transversely rugulose above and the punctuation is more superficial and less regular. *Ph. mœrens* is undoubtedly very closely related to *flavens*, and when this and the allied species have been more closely studied may prove to have only subspecific rank.

41. **Aphænogaster relicta** sp. nov. (Fig. 8*c*.)

Worker. Length 4–5 mm.

Head about $1\frac{1}{2}$ times as long as broad, a little broader in front than behind, where it is rounded and without distinct posterior corners, but with a distinct occipital margin which is somewhat elevated on each side at the posterior end of the gula. Eyes moderately large and convex, just in front of the middle of the sides of the head. Mandibles rather large, with the external borders straight at the base, more convex at the tips; their apical borders with 6 or 7 teeth, those near the base being short and broad. Clypeus moderately convex in the middle, depressed on the sides, its anterior border somewhat projecting, with a narrow but distinct notch in the middle. Frontal carinæ elevated and rounded in front, lower, more approximated and subparallel behind. Antennæ rather stout, the scapes reaching fully twice their greatest diameter beyond the posterior border of the head, at the base with a compressed, rounded lobe, not unlike that on the scapes of *Myrmica scabrinodis;* funicular joints, except the last, subequal, about $1\frac{1}{2}$ times as long as broad. Thorax long and robust, pro- and mesonotum narrower than the head, in profile hemispherical; seen from above

the pronotum is rather angular in front just behind the neck and more convex on the sides, behind. Mesoëpinotal constriction deep and rather narrow Epinotum longer than high, its base in profile rather convex in front, more flattened behind, twice as long as the rather sloping declivity, armed with two powerful, acute spines, which are nearly as long as the base of the epinotum, directed backward, upward and outward and slightly curved downward. Petiole from above about twice as long as broad, broadest behind, with slightly concave sides; node in profile with a longer, slightly concave anterior and a shorter, convex posterior declivity and a rather acute summit; seen from behind its border is rounded and entire. Postpetiole as long as broad, broadest behind, where it is half again as broad as the petiolar node, rounded in profile above and swollen ventrally at its anterior end. Gaster broadly elliptical. Legs long and rather stout.

Mandibles subopaque, densely and coarsely striated. Clypeus, head and thorax subopaque, very coarsely, reticulately rugose, the rugæ on the head somewhat finer than those on the thorax and with a more longitudinal trend. Epinotal spines

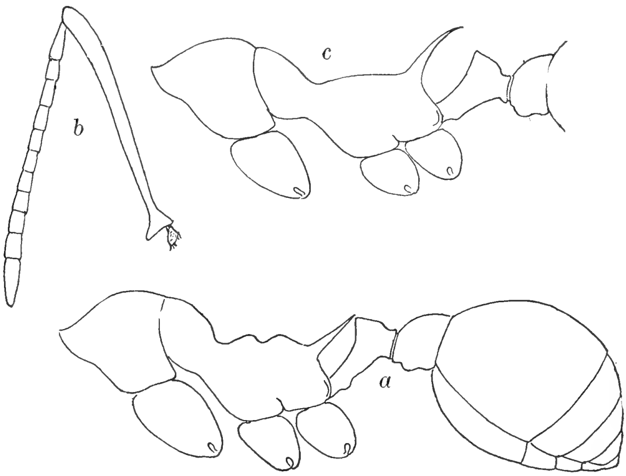

Fig. 8. *Aphænogaster relicta* sp. nov. and *A. relicta* subsp. *epinotalis* subsp. nov. Worker. a, profile of body of subsp. *epinotalis;* b, antenna of subsp. *epinotalis;* c, profile of thorax and pedicel of *A. relicta.*

shining at their tips, finely longitudinally striated at the base; epinotal declivity transversely rugulose. Neck of pronotum, petiole, postpetiole, basal and middorsal portion of first gastric segment, scapes and legs, opaque, densely and evenly punctate, with much sparser, evenly distributed and coarser piligerous punctures. Sides of first segment and the whole of the remaining gastric segments smoother, more sparsely punctate and more or less shining. Antennal funiculi rather shining.

Hairs glistening white; coarse, pointed, erect, rather long, moderately abundant, covering the body and appendages, shorter and more reclinate on the scapes and tibiæ.

Deep black; mandibles, except their bases and borders, tarsi, articulations of legs, two large spots on the base of the gaster and the upper surface of the postpetiole, dull red. In some specimens the two gastric spots are fused into one and in others the entire gaster and postpetiole are black.

Female (deälated). Length nearly 6 mm.

Differing from the worker in the shape of the thorax. The mesonotum is only moderately, the scutellum very convex and protuberant, the base of the epinotum long, slightly sloping and straight in profile, with the spines much stouter, less divergent and shorter than in the worker, being shorter than the distance between their bases. The rugosity of the thorax is somewhat finer than in the worker and the mesopleuræ are densely punctate. The sculpture of the remainder of the body, the pilosity and color are like those of the worker.

Male. Length 4 mm.

Head through the eyes about as long as broad, produced backward and somewhat conical behind. Cheeks moderately short. Mandibles feeble, but distinctly denticulate. Anterior border of clypeus broadly rounded and entire. Antennæ slender; scapes about 5 times as long as broad, first funicular joint slightly swollen, about twice as long as broad, increasing in length towards the tip. Thorax robust, the anterior portion of the pronotum projecting forward, convex, flattened behind; epinotum unarmed, sloping, without distinct base and declivity. Petiole, postpetiole and gaster similar to those of the worker.

Head, thorax, pedicel and basal half of first gastric segment opaque, densely punctate, remainder of gaster and legs shining and more superficially punctate. Mesonotum with a smooth, shining median longitudinal line.

Pilosity very similar to that of the worker.

Black; mandibles and genitalia yellow; clypeus and antennæ brown; legs piceous; wings faintly infuscated, with pale veins and stigma.

This beautiful species, the first *Aphænogaster* to be found in the West Indies, is described from numerous workers, a single female and a single male taken from several colonies at Diquini, Petionville, Port au Prince and in the mountains north of Jacmel. It nests in the earth in holes beneath stones in moist localities, usually on hill-sides. The workers are timid and very rapid in their movements. They are quite unlike the workers of any of our other North American species of *Aphænogaster* in the shape of the antennal scapes, in sculpture and coloration. The species is probably an ancient insular relict, confined to the island of Haiti.

42. **Aphænogaster relicta** subsp. **epinotalis** subsp. nov. (Fig. 8*a* and *b*.)

Worker. Differs from the typical form in having the base of the epinotum shorter and with a median transverse impression in the middle, very distinct in profile; the epinotal spines are shorter, straight and distinctly less erect and the red on the postpetiole and gaster is duller.

Described from a series of specimens taken at Manneville.

43. **Pogonomyrmex (Ephebomyrmex) schmitti** *Forel.* (Fig. 9.)

Pogonomyrmex schmitti Forel, Ann. Soc. Ent. Belg., XLV, 1901, p. 339, ☿.
Pogonomyrmex (*Ephebomyrmex*) *schmitti* Wheeler, Psyche, 1902, p. 390, ☿.
Worker. Length 3.5–4 mm.

Head subrectangular, a little longer than broad, as broad in front as behind, with rather straight sides and feebly excised posterior border. Mandibles convex, with 6 subequal teeth. Clypeus short, convex; its anterior border entire and broadly rounded. Frontal area elongate, triangular. Antennæ rather stout, their scapes not reaching to the posterior border of the head; joints 2–7 of the funiculi somewhat broader than long. Thorax short and broad, but little longer than the head, with the mandibles, including the neck nearly twice as long as broad, evenly convex above in profile, without promesonotal and mesoëpinotal sutures. Epinotum sloping, its base and declivity subequal, bearing two short, stout spines, which are directed backward, upward and outward and are longer than broad at their bases and shorter than their distance apart. Metasterna prolonged upward and backward into a pair of similar but somewhat shorter spines, which are slightly curved forward. Petiole from above fully twice as long as broad, with a slender peduncle occupying half its length and provided with a stout, triangular tooth on its ventral surface. The node, which is as broad as half the length of the whole segment, when seen in profile has a straight anterior surface rising at a right angle from the peduncle and half as long as the sloping posterior surface. The two surfaces meet at a sharp ridge, which, seen from above, forms the broadly rounded anterior margin of the node; its sides are straight and converge posteriorly to the postpetiole, which is broader than the petiole, a little broader than long, campanulate and provided with a large swelling on its anteroventral surface. Gaster slender, elongate-elliptical, with a powerful sting. Legs long and stout.

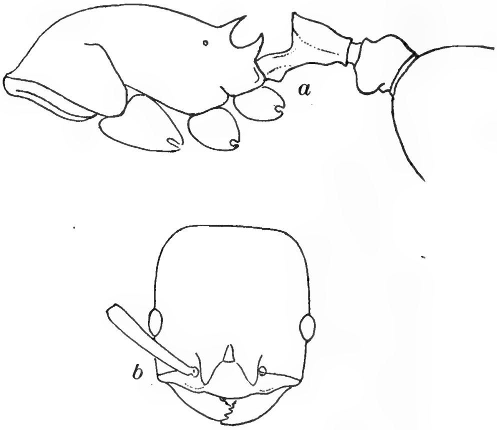

Fig. 9. *Pogonomyrmex (Ephebomyrmex) schmitti* Forel. Worker, a, profile of thorax and pedicel; b, head from above.

Mandibles and head opaque, the former and the clypeus rather finely and regularly longitudinally rugose, the head somewhat more coarsely, the rugæ with reticulate-punctate spaces between them and diverging somewhat from the median line on the posterior portion of the head. Thorax still more coarsely and somewhat more irregularly and reticulately, longitudinally rugose. Petiole, postpetiole and basal third or half of first gastric segment opaque and densely punctate the posterior surface of the petiolar node also longitudinally rugulose. Posterior portion of first gastric segment and the remaining segments shining, very superficially shagreened or reticulate, with small, sparse, piligerous punctures. Legs and scapes densely punctate, the former feebly shining, the latter opaque.

Hairs short, stiff, pointed, dark brown or blackish, moderately abundant, erect on the body, somewhat more reclinate on the legs and scapes. Gula without ammochætæ.

Black; mandibles, tip of gaster, tarsi beyond the first joint and sometimes also the peduncle of the petiole, the legs and clypeus (in immature specimens?), deep red.

Female (deälated). Length 5.5 mm.

Closely resembling the worker, but differing in the following characters. The rugæ on the mesonotum, scutellum and pleuræ are more regularly longitudinal and the epinotum and posterior surface of the petiolar node are coarsely reticulate-rugose. The epinotal spines are stouter and proportionally longer than the metasternal spines, and the gaster, though small, is proportionally broader than in the worker.

Described from numerous workers and a single female from Cape Haitien, Furcy, Petionville, Diquini, Port au Prince and the mountains north of Jacmel. These specimens all agree closely with Forel's description and with a cotype received by the senior author many years ago from Rev. P. J. Schmitt, O. S. B., to whom the species was dedicated. *P. schmitti* nests in the ground in crater nests, but sometimes also under stones. It is a harvesting ant like the other species of the genus, and like these is also fond of eating insects, for the junior author often saw workers carrying whole insects or fragments of them into the nest.

44. **Pogonomyrmex (Ephebomyrmex) schmitti** *Forel* var. **sublævigatus** var. nov.

The worker and female differ from those of the preceding form in having the postpetiole and base of the gaster smooth and shining like the remainder of the abdomen or with only traces of the fine punctures at the extreme base of the first segment.

This variety was taken at Manneville and Ennery.

45. **Pogonomyrmex (Ephebomyrmex) saucius** sp. nov. (Figs. 10 and 11.)

Worker. Length: 5–5.5 mm.

Head subrectangular, a little longer than broad, with straight sides and feebly excised posterior border and the eyes just in front of the middle of its sides. Mandibles with 6 subequal teeth and rather convex external borders. Clypeus with straight, entire anterior border and a blunt, tooth-like projection on its upper surface on each side near the lateral border. Frontal area small, elongate-triangular. Antennal scapes not reaching to the posterior corners of the head; joints 2–7 of the funiculi as broad as long. Thorax shaped as in *P. schmitti* and with similar spines on the epinotum and metasterna. Postpetiole, petiole and gaster also similar in structure, but the anterior surface of the petiolar node rises a little less abruptly from the peduncle and the posterior surface is more convex and, when seen from above, its anterior border is more pointed or acuminate in the middle.

Mandibles, head and thorax opaque. Mandibles striated; clypeus, head and thorax regularly longitudinally rugose, the interrugal spaces being finely and densely

punctate. On the cheeks the rugæ are rather far apart but are denser and diverge posteriorly on the posterodorsal portion of the head. The space enclosed by the four thoracic spines, is concave, smooth and shining. Petiole, postpetiole and gaster also smooth and shining, with small, sparse piligerous punctures, except the dorsal surface of the petiolar node, which is densely punctate and longitudinally rugose, the rugæ converging anteriorly to the apex of the node. Antennal scapes and legs finely shagreened, the former opaque, the latter somewhat shining.

Hairs dark brown, short, stiff, moderately abundant, erect on the body, somewhat more oblique on the scapes and legs. Gula without ammochætæ.

Brownish black; mandibles, except their teeth and borders, sides of clypeus, cheeks, antennæ, legs, thoracic spines, peduncle of petiole, anterior border and sides of postpetiole and a band across the anterior border of the first gastric segment, red. Tip of gaster and margins of posterior gastric segments narrowly yellowish.

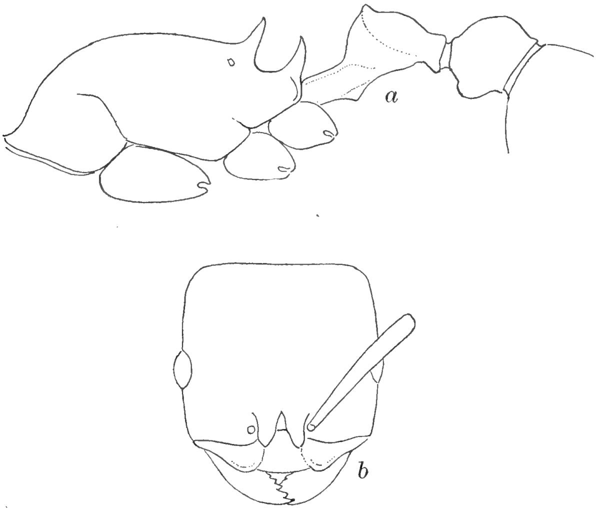

Fig. 10. *Pogonomyrmex (Ephebomyrmex) saucius* sp. nov. Worker. a, profile of thorax and pedicel; b, head from above.

Male. Length 4–4.5 mm.

Head slightly longer than broad, with large eyes and ocelli, narrowest through the cheeks, which are straight, rounded and broader behind the eyes. Mandibles like those of the worker but smaller. Clypeus convex, without lateral tooth-like projections. Antennal scapes scarcely four times as long as broad, somewhat curved and dilated at the base; first funicular joint a little longer than broad, second as long as the scape, joints 3–9 subequal, a little more than twice as long as broad; joints 10 and 11 shorter, terminal joint nearly as long as the two preceding together. Thorax robust, through the wing insertions as broad as the head. Mesonotum with well-marked Mayrian furrows, convex in front, flattened behind; epinotum and metasterna unarmed, the former rounded without distinct base and declivity. Petiole long; its node rounded in profile, constricted behind; its peduncle with a distinct ventral tooth. Postpetiole similar to that of the worker. Fore wing with a discal and two cubital cells.

Head, thorax and petiole opaque, finely and densely punctate, head and thorax also longitudinally rugulose above and on the sides of the epinotum. Mandibles, postpetiole and gaster shining, the mandibles coarsely and sparsely punctate and at the base finely striate. Legs rather shining, finely shagreened.

Pilosity similar to that of the worker.

Black; tips of mandibles, funiculi tibiæ, tarsi, bases and tips of femora, red; genitalia brown. Wings grayish hyaline, with brown veins and stigma.

Fig. 11. Desert at Manneville showing nesting site of *Pogonomyrmex* (*Ephebomyrmex*) *saucius* sp. nov. beneath stones in left foreground.

Described from numerous workers and two males taken from a couple of colonies nesting in the ground beneath stones along the very arid trail leading from Manneville to the Dominican border, about half a mile from the former place. Each of the nests contained a little heap of stored grain. The species is apparently restricted to this arid region, and no doubt ranges over the territory about Lake Assuei. It is a more timid ant than *P. schmitti*, from which species it is readily distinguished in the worker phase by its larger size, the different and more regular sculpture of the thorax, the tooth-like projections on the clypeus and the peculiar coloration.

46. **Macromischa sallei** (*Guérin.*)

Myrmica sallei Guérin, Rev. Mag. Zool. Pure et Appliq. (2), IV, 1852, p. 76, pl. iii, figs. 2–4, ☿ ♀ ♂.

Macromischa sallei Forel, Biol. Central. Amer., 1899–1900, p. 57, *nota*, ☿ ; Bull. Soc. Ent. Suisse, X, 1, p. 272.

Worker. Length about 5 mm.

Head subrectangular, a little longer than broad, with feebly convex sides, nearly straight posterior border, rounded posterior corners and convex eyes at the middle of the sides. Mandibles rather convex, with 4 or 5 subequal teeth. Antennæ slender, their scapes reaching somewhat beyond the posterior corners of the head; funicular joints all longer than broad, the three terminal ones largest and forming a club. Thorax longer than the head, including the mandibles, and narrower, broadest through the pronotum, which is somewhat flattened above and on the sides and separated from the mesonotum by a distinct suture and shallow constriction both dorsally and laterally Meso- and epinotum not separated by a constriction or suture, nearly as broad as the pronotum, longer than broad, with feebly convex lateral and dorsal surfaces. Epinotum bearing two straight spines, which are nearly as long as the dorsal surface of the meso- and epinotum, stout and close together at the base but rapidly tapering to acute tips, directed backward, rather strongly outward and slightly upward. Petiole nearly three times as long as broad, with a slender peduncle making up the anterior $\frac{2}{3}$ of its length and at the posterior third with an abrupt, rounded, slightly transverse node, which is much higher than the postpetiole. This is about half again as broad as the petiolar node, campanulate and somewhat narrower in front than behind. Gaster small, elliptical with a well-developed sting. Legs long; femora slender at the base, strongly incrassated just beyond the middle; tibiæ clavate, without spurs.

Head and thorax opaque; petiole, postpetiole and gaster shining. Head finely longitudinally rugose and punctate; thorax also longitudinally rugose, more coarsely and irregularly on its dorsal than on its pleural surface. Legs shining, sparsely punctate.

Hairs pale, whitish, coarse, long and suberect, covering the body and appendages, including the antennal funiculi.

Color ferruginous red; legs paler; gaster black, except in some specimens which have the base of the first segment ferruginous. Antennal funiculi infuscated.

Female. Length 7 mm.

Resembling the worker in color and sculpture, except that the borders of the ocelli, the scutellum and mesonotum are black and at least the basal third of the first gastric segment is ferruginous. The head is more elongate and elliptical and more rounded behind. Wings pale yellowish, with yellow veins and stigma. There is no discal and only one cubital cell.

Male. Somewhat less than 5 mm.

Head small, rounded behind. Eyes large and prominent. Mandibles small, pointed, less convex than in the worker, with finely dentate apical borders Antennæ slender, scapes half as long as the funiculi. Mesonotum with distinct Mayrian furrows. Epinotum unarmed. Petiole and postpetiole similar to those of the female, but the node of the former much lower, subconical and not transverse. Gaster small. Legs long and slender, scarcely incrassated. Venation of wings like that of female.

Color brown, passing into ferruginous on some parts of the body. Antennæ yellowish brown. Wings whitish, with yellow veins and stigma.

All three phases were taken by Auguste Sallé in April 1850 from arboreal nests in a large morass known as the Cienaga del Timbladero, near Rancho Arriba, on the River Nisae, in the heart of San Domingo.

The foregoing rather incomplete description is drawn from Guérin and from a single poorly preserved worker cotype (*ex* Coll. Saussure) presented

by Prof. Forel to the senior author. Guérin gives an excellent figure of the peculiar carton nest (pl. iii, fig. 1), which is very much like that of the following subspecies taken in Haiti.

47. **Macromischa sallei** (*Guérin*) subsp. **haytiana** subsp. nov. (Figs. 12, 13 and 14.)

Worker. Length 3.5–4.5 mm.

Closely resembling *M. sallei* in form, but somewhat smaller and more slender, and with the long epinotal spines less thickened at the base. Mandibles, clypeus

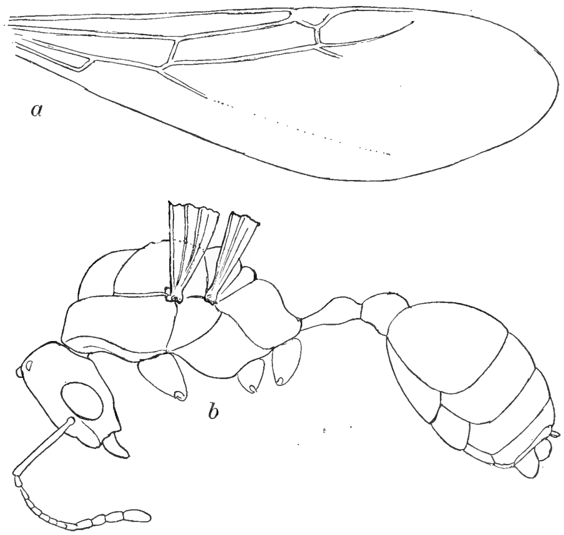

Fig. 12. *Macromischa sallei* (Guérin) subsp. *haytiana* subsp. nov. Male. a, wing; b, body in profile.

and frontal area slightly shining, longitudinally rugose; head opaque, densely and finely longitudinally rugulose-punctate. Thorax coarsely and somewhat vermiculately longitudinally rugose and somewhat shining; epinotal declivity irregularly and transversely rugulose. Petiole and postpetiole rugose on the sides and below, their nodes smooth and shining. Petiolar node fully as long as broad, not transverse. Gaster and legs shining, with sparse piligerous punctures; antennal scapes opaque.

Hairs white, coarse, moderately long and abundant, suberect, covering the body and appendages; pubescence absent.

Mandibles and head yellowish red; cheeks, sides and border of clypeus and borders of mandibles reddish brown. Thorax blackish red or dark purplish brown, pronotum often paler. Petiole, post-petiole, gaster, legs and antennæ black; tarsi beyond the first joint reddish.

Female (deälated). Length 6.5 mm.

Fig. 13. View at Furcy. Home of *Macromischa sallei* Guérin subsp. *haytiana* subsp. nov.

Closely resembling the worker in form and color. The rugæ on the head are sharper, those on the thorax much finer and more regular, and those on the sides of the petiole and postpetiole more distinct.

Male. Length: 4–4.3 mm.

Mandibles smooth, scarcely shining; head opaque, finely punctate; the clypeus and dorsal surface also longitudinally rugulose. Thorax, petiole and postpetiole subopaque, the surface of the thorax irregularly, that of the epinotum transversely rugose. This portion of the thorax is unarmed, convex and sloping, without distinct base and declivity. Petiole with a very low node. Postpetiole and gaster similar to those of the worker. Legs long and slender, without incrassated femora and tibiæ.

Pilosity similar to that of the worker.

Black; mandibles, antennae and tarsi yellow; clypeus, frontal area and three large spots on the mesonotum red. Femora and tibiæ piceous or black. Wings whitish hyaline, with pale yellow veins and stigma.

Described from numerous workers and males and a single female taken from several carton nests at Furcy in a locality represented in the accompanying figure (Fig. 13). The typical *M. sallei* is described by Guérin as nesting in trees in marshy places, but the subsp. *haytiana* lives on bushes in the mountains in regions which are never flooded. Both forms are extremely abundant in the restricted localities in which they occur and form very populous colonies, unlike most species of *Macromischa.* Along the ridge at Furcy the junior author observed hundreds of nests of *haytiana,* usually built in a peculiar shrub which is the most abundant and typical plant of the region. This shrub, which has very dense, short leaves and extra-nuptial nectaries, has been kindly identified for us by Prof. Robinson of the Gray Herbarium as *Baccharis myrsinites* (Lam.) Pers. The matted foliage produced by the numerous stems and densely leaved branches of this shrub afford the ants shade and concealment. Occasionally nests were also observed in other trees, especially in the smaller pines and among the plants of the small coffee plantations. The nest varies in diameter from about 1 to 6 or 7 inches, and also in shape, though it is always more or less oval or elliptical, at least when fully developed. The smaller nests are built around the stem of the plant, in such a manner as to embrace in their substance the insertions of the branches. At first sight the carton of which these structures consist, resembles that of certain species of *Azteca* and *Crematogaster,* but it seems to consist of finely shredded grass, which is afterwards cemented together and covered with true carton. Additions are made to the nest in this manner and some are often found consisting of carton throughout, excepting an envelope of the fine fibres, which may or may not cover the whole surface. Occasionally one may find a nest consisting of the fibrous material throughout. As none of the latter variety contained larvæ or pupæ, they are probably to be regarded as tents or pavilions erected as shelters over the extrafloral nectaries of the plants.

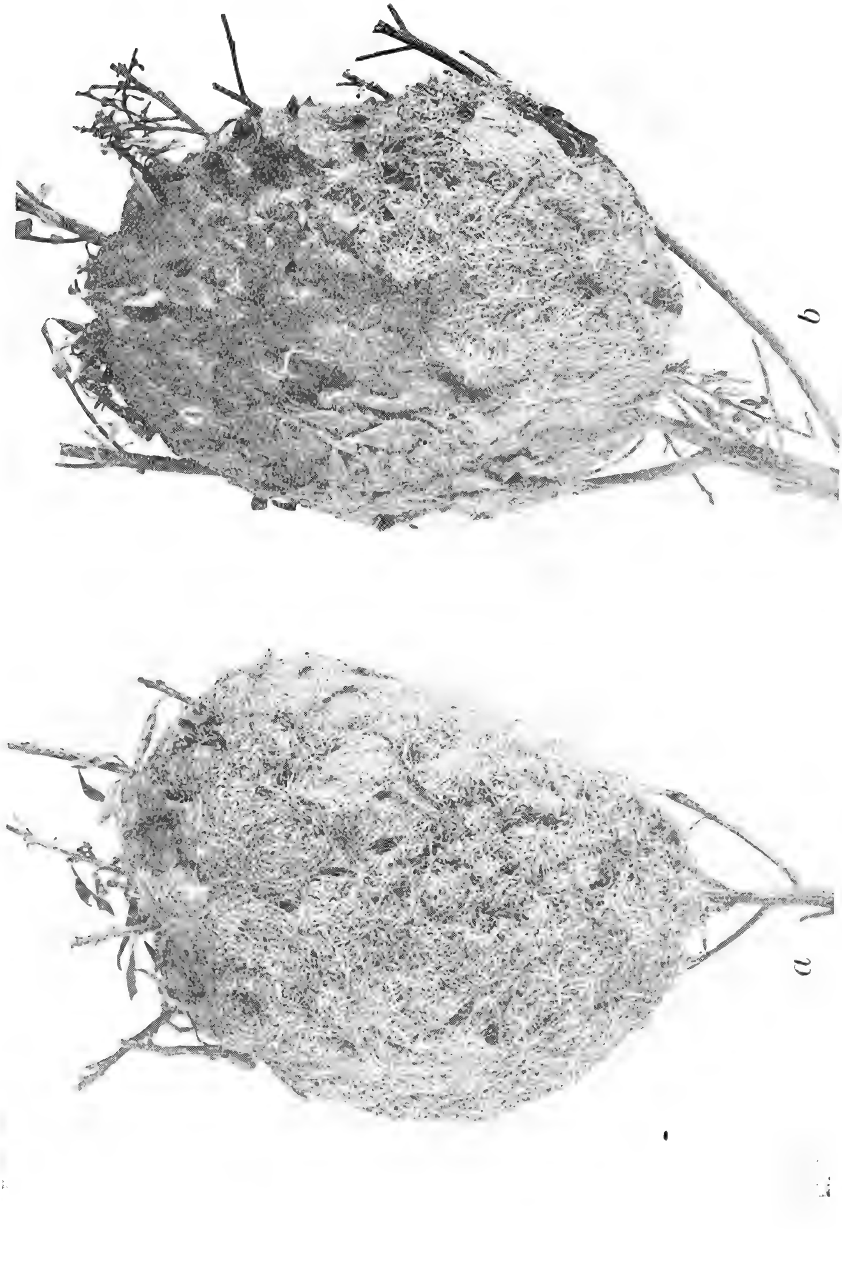

Fig. 14. Nests of *Macromischa sallei* (Guérin) subsp. *haytiana* subsp. nov.

M. haytiana is diurnal in habit. It is evidently omnivorous, as it was seen attending Aphids and Membracids and the nectaries of the plants, and as its nests contained pieces of insects, mostly Orthoptera, and some objects which seemed to be plant seeds. In one nest a living Membracid nymph was found. The workers are pugnacious and sting severely. When the nest is disturbed they rush forth and scatter over all parts of the bush, and while moving about carry the gaster bent down beneath the thorax with the sting directed forward, a habit which is permitted by the great length of the petiole. This same habit has also been observed by the senior author in some of the other species of the genus (*M. splendens* Wheeler of the Bahamas and *M. isabellæ* Wheeler of Porto Rico).

48. **Macromischa flavidula** sp. nov. (Fig. 15.)

Worker. Length 1.5–1.7 mm.

Head somewhat longer than broad, as broad in front as behind, with evenly convex sides, nearly straight posterior border, rounded posterior corners and the moderately convex eyes at the middle of the sides. Mandibles with rather straight external and finely denticulate apical borders. Clypeus convex, with broadly rounded anterior border. Frontal carinæ subparallel; frontal area indistinct. Antennal scapes reaching to the posterior border of the head; club of funiculus large, 3-jointed; remaining joints, except the first, small, broader than long. Thorax short, about as long as the head with the mandibles, a little broader in front than behind, in profile with evenly rounded, convex dorsum, without any traces of promesonotal or mesoëpinotal sutures; humeri rounded, epinotum sloping, without distinct base and declivity, bearing two spines which are longer than the declivity and much longer than their distance apart, curved downward and directed backward and outward. Petiole with a short, slender peduncle, bearing a small, acute tooth on its ventral surface, and a node which is longer than broad, with its anterior declivity in profile sloping and slightly concave, its summit slightly flattened and its posterior declivity very short and convex. Postpetiole large, broader than long, three times as broad as the petiole behind, in profile rounded and convex above. Gaster small, at the base only a little broader than the postpetiole. Legs rather short; femora slightly incrassated.

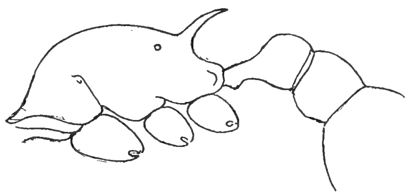

Fig. 15. *Macromischa flavidula* sp. nov. Profile of thorax and pedicel of worker.

Whole surface of body very smooth and shining.

Hairs white, blunt, short, scattered and erect on the body, very minute and appressed on the scapes and legs.

Yellow; mandibles, antennæ, epinotal spines, legs and venter paler and more whitish.

Female (deälated). Length: 3.3 mm.

Differing from the worker in the following characters: The head is subcircular, not longer than broad, with more convex sides. The epinotal spines are shorter and stouter and not curved, the upper surface of the mesonotum is flattened and the gaster is large and elongate elliptical, the postpetiole even broader in proportion to its length. The wing insertions, a spot on the scutellum, a broad band across the first gastric segment and a much narrower band near the posterior border of each of the following segments are brown.

Described from three workers and a female taken from a single nest in the ground under a stone at Manneville. This is the smallest known species of *Macromischa* and differs also from the other members of the genus in color and sculpture, though it is morphologically closely related to a group of small species embracing *M. subditiva* Wheeler of Texas, *albispina* Wheeler of Culebra Island and *lævissima* Wheeler of Mexico.

49. **Tetramorium guineense** *Fabricius.*

Formica guineensis Fabricius, Ent. Syst., II, 1793, p. 357, ☿.

Several workers and females from Diquini, Grande Rivière, Manneville, Momance and Ennery. This tropicopolitan ant must have been introduced into the island more than 60 years ago, as it is cited from San Domingo by Guérin (Rev. Mag. Zool. (2) 1852, p. 79).

50. **Tetramorium (Tetrogmus) simillimum** *F. Smith.*

Myrmica simillima F. Smith, List Brit. Anim. Brit. Mus., VI, 1851, p. 118, ☿.

Numerous workers and females from Diquini, the mountains north of Jacmel, Manneville and Grande Rivière. Like the preceding this is a well-known tramp species which originated in the Old World tropics.

51. **Wasmannia auropunctata** *Roger.*

Tetramorium ? auropunctatum Roger, Berl. Ent. Zeitschr., VII, 1863, p. 182, ☿ ♀ ♂.

Numerous workers and deälated females from Diquini, Milot, Ennery, Grande Rivière, Petionville, and the mountains north of Jacmel. This species is widely distributed through the West Indies, Mexico and Central America.

52. **Cryptocerus hæmorrhoidalis** *Latreille.* (Fig. 16.)

Latreille, Hist. nat. Fourm., 1802, p. 276, ☿.

Cryptocerus hamulus Roger, Berl. Ent. Zeitschr., VII, 1863, p. 209, ☿.

Cryptocerus hamulus Roger var. *haytianus* Forel, Ann. Soc., Ent. Belg., XLV, 1901, p. 337, ☿.

Comparison of the descriptions of Latreille, Roger and Forel and a cotype of the var. *haytianus* received from Rev. P. J. Schmitt with a large series of workers taken by the junior author from several colonies at Port au Prince, Manneville, Diquini, Ennery and in the mountains north of Jacmel, shows that Roger's and Forel's forms are in all probability merely synonymous with Latreille's. Latreille's specimen came from San Domingo and had the anal region red like the sides of the head, but this is true also to some extent of our specimens and of the cotype *haytianus*, and, we believe, represents merely a sporadic variation the occurrence of which is rendered probable by the peculiar color of the male (*vide infra*). Roger's specimens also came from San Domingo. Forel believes that his variety certainly differs from *hamulus* in the shape of the spines on the petiole and the rugæ of the occiput, but our series shows that the small spines on the petiole are variable and may be either present or absent in individuals from the same colony, and Roger describes the occiput as coarsely longitudinally rugose ("die Hinterseite des Kopfes gröber längsrunzelig").

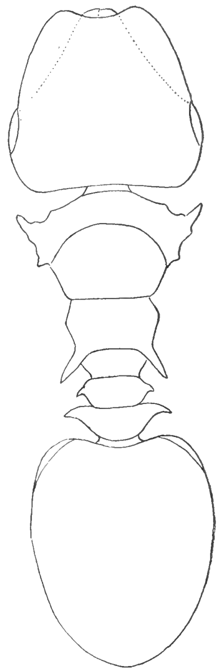

Fig. 16. *Cryptocerus hæmorrhoidalis* Latreille. Worker from above.

A single male specimen from Port au Prince is peculiar in coloration. It has the head, thorax, petiole and postpetiole black; the tips of the mandibles, palpi, legs, antennal scapes and gaster fulvous, the funiculi brown. The wings are blackish, with dark brown veins and stigma. The body is subopaque, except the gaster, which is feebly shining. The hairs are fulvous and erect, abundant and conspicuous on the head and thorax, much sparser and appressed on the gaster and legs.

Although many colonies of this ant were seen in Haiti, only one type of worker was found in them. This fact and the singular conformation of the body of the worker show a marked resemblance to the species of the genus *Procryptocerus*. The nests are usually in hollow twigs, but at Port au Prince several colonies were found nesting in fence-posts.

53. **Cryptocerus varians** *F. Smith* subsp. **marginatus** subsp. nov. (Fig. 17.)

Soldier. Differing from the typical form from Florida, Cuba and the Bahamas

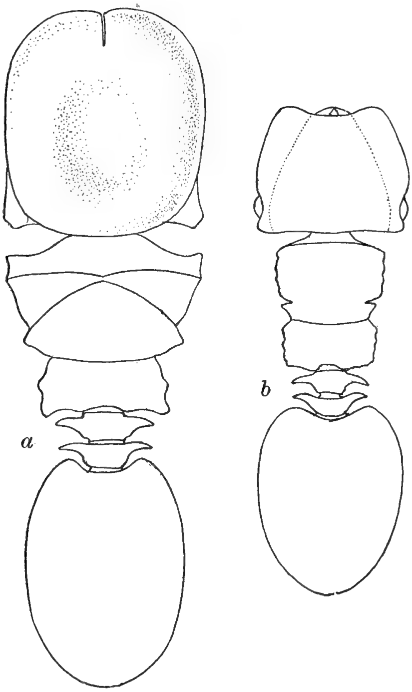

Fig. 17. *Cryptocerus varians* F. Smith subsp. *marginatus* subsp. nov. a, soldier, dorsal view; b, worker, dorsal view.

in having the spines on the petiole and postpetiole distinctly longer, the large spines on the epinotum stouter, blunter and less compressed, and the color of the body and legs darker and more blackish.

Worker. Differing from the typical *varians* in having the thorax broader, with flatter and more regular border on each side, the spines of the petiole and postpetiole much longer and flatter and the color darker as in the soldier.

Female (deälated). Color darker than in the female of the typical form, the whole body being black, with only a faint reddish tinge to the legs, thorax and pedicel.

Described from numerous soldiers and workers and a single female from Diquini, St. Marc, Petionville and Manneville. The colonies were nesting in hollow twigs on the estate at Diquini, frequently also in bamboo.

54. **Strumigenys alberti** *Forel.*

Trans. Ent. Soc. London, 1893, p. 380, ☿ ♀.

Several workers and a deälated female from Manneville, Ennery, Grande Rivière, Petionville, Diquini and the mountains north of Jacmel, agree very closely with the typical form of this species from St. Vincent.

55. **Strumigenys rogeri** *Emery.*

Pyramica gundlachi Roger, Berl. Ent. Zeitschr., 1862, VI, p. 253, ♀ (*nec* ☿).
Strumigenys rogeri Emery, Bull. Soc. Ent. Ital., 1890, XXII, p. 31, pl. 7, fig. 6, ☿.

Six workers and a deälated female from the mountains north of Jacmel. This species occurs also in St. Thomas, Cuba and Porto Rico.

56. **Strumigenys unispinulosa** *Emery.*

Bull. Soc. Ent. Ital., XXII, 1890, p. 31, pl. 7, fig. 5, ☿ ♀.

Several workers and deälated females from Cape Haitien, Grande Rivière and Diquini. This species was originally described from Alajuela, Costa Rica.

57. **Atta (Trachymyrmex) jamaicensis** *Ern. André.*

Rev. d'Entomol., 1893, p. 149, ☿.

Numerous workers, three males and a single female from St. Marc, Diquini, Manneville and Port au Prince agreeing in all respects with specimens from Jamaica, the Bahamas and Culebra Island. This ant forms rather large colonies. At Manneville it was found nesting in dry, sandy soil on the plain near Lake Assuei. Here the insects had thrown up broad, low craters about the nest entrances. In other localities the nests were in more humid situations. In all cases, however, they were in the shade. The ants collect small pieces of leaves, buds and other vegetable substances as a substratum for the fungus which they cultivate, as has been shown by the senior author in a former paper (The Fungus Growing Ants of North America. Bull. Amer. Mus. Nat. Hist., XXII, 1907, p. 760). The workers are diurnal but seem to prefer the late afternoon for foraging.

58. **Atta (Trachymyrmex) jamaicensis** *Ern. André* subsp. **haytiana** subsp. nov. (Fig. 18.)

Worker. Length: 3.5–4 mm.

Differing from the typical form in having the anterior spines or tubercles on the posterior corners of the head shorter, in having a well-developed, pointed median

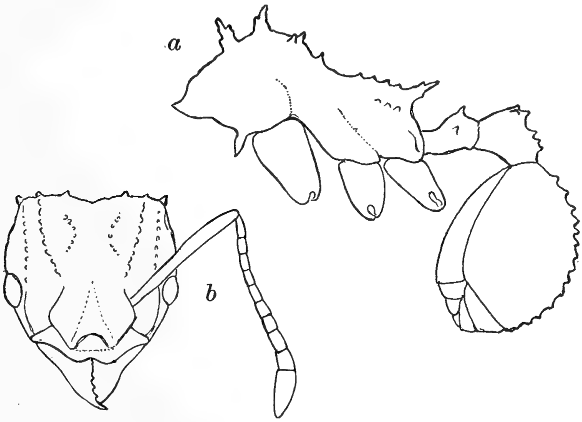

Fig. 18. *Atta (Trachymyrmex) jamaicensis* Ern. André subsp. *haytiana* subsp. nov. Worker. a, profile of body; b, head from above.

tubercle on the pronotum and in coloration, the body being entirely black, with the exception of the mandibles, funiculi, articulations of the legs and tarsi beyond the first joint, which are red.

Described from several workers taken from a single colony in a canyon near Petionville. The nest entrance opened directly on the surface of the ground and was not surrounded by a crater.

59. **Mycocepurus smithi** *Forel.*

Forel, Trans. Ent. Soc. London, 1893, pp. 370–372, ☿.

Several workers of the typical form of this species, first described from St. Vincent, were taken at Cape Haitien and Diquini. The nests in the latter locality were in the form of small craters and were located in clay soil in a moist spot in a gully formed by a small stream. Several colonies were nesting in an area about 25 ft. square, but in no other place in the neighborhood. At Cape Haitien only a single colony was found and this was nesting in a road leading across the mountains and nearly at the summit.

60. **Cyphomyrmex rimosus** *Spinola* var. **minutus** *Mayr.*

Cyphomyrmex minutus Mayr, Verh. Zool. bot. Gesell. Wien, XII, 1862, p. 691, ☿.

A large number of specimens of all three phases of this widely distributed form were taken at Momance, Diquini, Petionville, Ennery, Grande Rivière, Manneville, St. Marc and in the mountains north of Jacmel. These specimens vary considerably in color but this is probably due, in part at least, to age.

Subfamily Dolichoderinæ.

61. **Dorymyrmex pyramicus** *Roger* var. **niger** *Pergande.*

Proc. Cala. Acad. Sci., 1895, ser. 2, V, p. 871, ☿.

Several workers and females from Diquini and Manneville. This dark variety seems to be the most abundant form of the widely distributed *pyramicus* occurring in the West Indies.

62. **Iridomyrmex keiteli** *Forel.*

Mitth. Naturh. Mus. Hamb., XXIV, 1907, 2. Beiheft, p. 8, ☿ ♀.

The worker of this species, which was described from specimens collected in Haiti by G. Keitel, is readily distinguished from *I. melleus* Wheeler of Porto Rico, *I. humilis* Mayr and the allied *iniquus* Mayr by its much broader and more cordate head, shorter antennal scapes, stouter thorax, shorter and less constricted mesoëpinotal region, and more erect petiolar node. The female is described as having a vertical and much broader petiolar node. The typical form of this species was not seen by the junior author in Haiti, but he encountered the two following undescribed varieties instead:

63. **Iridomyrmex keiteli** *Forel.* var. **flavescens** var. nov.

Worker. Length 2–2.3 mm.

Differing from the typical *keiteli* in its slightly larger size and in coloration, the whole body being clear yellow, except the mandibular teeth, which are black, and the occipital impression of the head, which is very feebly infuscated.

Described from several specimens taken from a nest under a stone on a dry hill-side at Cape Haitien. This variety must closely resemble *I. melleus* Wheeler subsp. *succineus* Forel from Brazil, but the latter form is decidedly larger (2.6–2.9 mm.). Judging from Forel's description it, too, would seem to belong to *keiteli* rather than to *melleus.*

64. **Iridomyrmex keiteli** *Forel* var. **subfasciatus** var. nov.

Worker. Length 2–2.3 mm.

Differing from the two preceding forms in coloration. The head, thorax, petiole and middle portions of the femora are dark brown, with the mandibles, sides of clypeus, scapes, tibiæ and tarsi yellow; the gaster yellow, with a broad, brown, transverse band on the dorsal surface of each segment. The funiculi are also brownish.

Described from several workers taken at Diquini, Petionville and in the mountains north of Jacmel.

65. **Tapinoma melanocephalum** (*Fabricius.*)

Formica melanocephala Fabr., Ent. Syst., II, 1793, p. 353, ☿.

Three workers from Manneville.

66. **Tapinoma opacum** sp. nov.

Worker. Length 2–2.5 mm.

Head distinctly longer than broad, a little broader behind than in front, rounded behind, with feebly convex sides and rather large, flattened eyes, placed just in front of the median transverse diameter of the head. Mandibles with numerous minute teeth, the apical ones longer and acute. Clypeus moderately large and convex, with rounded, entire anterior border. Frontal area indistinct, triangular. Frontal groove obsolete. Antennæ rather long; scapes reaching fully twice their greatest diameter beyond the posterior margin of the head; second funicular joint broader than long, succeeding joints as long as broad, terminal joint longer. Thorax rather stout; pro- and mesonotum each somewhat broader than long, the meso-epinotal suture slightly but distinctly impressed in profile. Epinotum as long as broad, in profile sloping and rather flat, without distinct base and declivity. Petiole $1\frac{1}{2}$ times as long as broad, broader behind than in front, with a distinct though low scale, which is much inclined forward, narrowed and somewhat pointed anteriorly when seen from above. Gaster and legs as usual, the first segment of the former overlapping the petiole with its base.

Mandibles shining, finely punctate; remainder of body, including the antennæ and legs, opaque, very densely, finely and evenly punctate.

Hairs sparse, whitish, erect, present only on the clypeus, mandibles, prosterna and tip of gaster; pubescence whitish, very short and delicate, covering the whole body and giving it a faint bloom.

Black; legs and antennal funiculi piceous; tips of mandibles, tarsi and mouth-parts, including the palpi, yellow.

Male. Length 2.5 mm.

Resembling the male of *T. sessile* Say, except in its smaller size, sculpture and coloration. Head a little longer than broad; clypeus with straight, entire anterior border. Antennal scapes more slender than in the worker and reaching further beyond the posterior border of the head; funicular joints all distinctly longer than broad. Epinotum similar to that of the worker, but with more distinct base and declivity, the former fully twice as long as the latter. Petiole with a thick, low, erect, rounded node. Genitalia large, the external valves convex, rounded, as broad as long, internal valves much narrower, pointed and more claw-like than in *T. sessile.* Wings without a discoidal cell.

Sculpture like that of the worker, except the gaster, which is shining

Erect hairs even less developed than in the worker, absent on the head and gaster.

Color as in the worker; wings distinctly grayish, with darker gray veins and stigma.

Described from several workers and two males taken at Furcy beneath the bark of a fallen pine. This species is clearly distinct from any of the other described American members of the genus and can be readily recognized in the worker and male phases by its peculiar sculpture. The male is fully as large as the worker, so that it is excluded from the group of species comprising *T. melanocephalum,* Fabr., *litorale* Wheeler, *ramulorum* Emery, etc. and belongs in the group containing *T. erraticum* Latr. and *sessile* Say. The genitalia are also more massive as in these latter species.

Subfamily Camponotinæ.

67. **Brachymyrmex heeri** *Forel.*

Denkschr. schweiz. Ges. Naturw., XXVI, 1874, p. 91, ☿, taf. 1, fig. 17.

Three females, a male and several workers from Manneville belong to the typical yellow form of this well-known species. It was also found to be very common beneath stones, boards etc. on the shores of the salty Lake Assuei.

68. **Prenolepis (Nylanderia) vividula** *Nylander* subsp. **guatemalensis** *Forel* var. **itinerans** *Forel.*

Mitth. Naturh. Mus. Hamb., XVIII, 2. Beiheft, 1901, p. 81, ☿.

Several workers, females and males from Petionville, Manneville and Diquini. The workers agree perfectly with cotypes received from Prof.

Forel. These had been imported into Hamburg with orchids from Brazil. Both the male and female are pale yellow, the latter with a broad, deep brown band across the dorsal surface of each gastric segment and with the surface of the body more opaque and pubescent than that of the worker, as usual in the genus. The wings in both sexes are yellowish hyaline, with pale yellow veins and stigma and not infuscated as described by Forel for the typical *guatemalensis* and its var. *antillana* Forel.

69. **Prenolepis (Nylanderia) steinheili** *Forel.*

Trans. Ent. Soc. London, 1893, p. 342, ☿.

A few workers from Furcy and Manneville and a winged female from the former locality. This sex, which was not described by Forel, measures 4 mm. and does not, therefore, reach the size (4.4 mm.) which he records for the female of his var. *minuta*. It is dark brown, with yellow appendages, the gaster being darker than the head and thorax and with each of its segments bordered posteriorly with yellow. The wings are grayish hyaline, with pale brownish veins and stigma.

70. **Prenolepis (Nylanderia) fulva** *Mayr.*

Verh. Zool. bot. Gesell. Wien, XII, 1862, p. 698, ☿ ♀.

Recorded by Forel from Haiti (Mitth. Naturh. Mus. Hamb., XVIII, 1901, 2 Beiheft, p. 65).

71. **Prenolepis (Nylanderia) longicornis** (*Latreille*).

Formica longicornis Latreille, Hist. nat. Fourmis, 1802, p. 113, ☿.

Numerous workers and two deälated females from Diquini, St. Marc, Manneville and Petionville. This introduced species is very widely distributed in Haiti and is especially common on the western shore of Lake Assuei.

72. **Prenolepis (Nylanderia) longicornis** (*Latreille*) var. **hagemanni** *Forel.*

Mitth. Naturh. Mus. Hamb., XVIII, 2 Heft, 1901, p. 65, o; *ibid.*, XXIV, 2 Beiheft, 1907, p. 10, ☿.

This variety, originally described from the Congo, is recorded by Forel from Port au Prince. It is paler than the typical *longicornis,* the worker being "yellowish red, with the antennæ, palpi and legs whitish, excepting the coxae."

73. **Rhizomyrma parvidens** sp. nov.

Worker. Length 1.8–2 mm.

Head subrectangular, a little broader than long, as broad in front as behind, with straight sides and a slight angular excision in the middle of the posterior border. Eyes minute, consisting of about 4 small ommatidia, situated at the anterior third of the head. Mandibles oblique but with distinct basal and apical borders, the latter with 4 small subequal teeth, much smaller than in any of the known species of the genus. Clypeus short and convex, with the anterior border entire, straight and transverse in the middle. Frontal area distinct, triangular; frontal and occipital grooves distinct. Antennæ 10-jointed; scapes reaching to the posterior corners of the head; first funicular joint longer than broad, second joint small, as long as broad; joints 3–5 much broader than long, joints 7–8 as long as broad, terminal joint as long as the 3 preceding joints together. Thorax shaped much as in *Rh. goeldii* Forel, but shorter and stouter, at least behind, where it is as broad as in front; seen from above the sides are rather concave in the middle; pronotum much broader than long, with less convex humeri than in *goeldii*, mesonotum not longer than broad, as it is in *goeldii*, fitting into the semicircular excavation of the posterior portion of the pronotum, convex and rising above the latter in profile, abruptly sloping behind to the mesoëpinotal constriction which is pronounced but very short. Epinotum distinctly broader than long, in profile lower than the mesonotum, with rather straight base and declivity meeting at a rounded, obtuse angle, the base distinctly longer than the declivity. Petiole with an erect, well-developed scale, which is a little more than half as broad as the epinotum, but not as high, compressed anteroposteriorly, with flattened anterior and posterior surfaces and rather blunt, entire, broadly rounded superior border. Gaster rather large, elliptical. Legs stout.

Body shining, finely shagreened and sparsely punctate. Mandibles and clypeus somewhat more opaque.

Hairs and pubsecence whitish or pale yellow, the former rather long, unequal, erect and confined to the body, the latter rather dense and short, covering both body and appendages, but not obscuring the shining surface.

Pale brownish yellow throughout; legs and antennæ a little paler, head in some specimens a little darker, only the eyes and mandibular teeth brown.

Described from three workers, two taken at Petionville and one at Diquini. This species may be the worker of *Rh. smithi* Forel, which is known only from the female taken in St. Vincent. The worker is certainly very different from *Rh. goeldii* Forel of Brazil and *exsanguis* Wheeler of Mexico in the structure of the mandibles and thorax. Moreover the integument is not thin and collapsible as in *exsanguis,* the eyes are somewhat larger and the second funicular joint is longer. The worker *goeldii* has 11-jointed antennæ (at least this is the number in a cotype received from Prof. Forel) and the second funicular joint is decidedly transverse. The mandibles of *Rh. parvidens* are much like those of *Rh. decedens* Mayr of South America but the median funicular joints are much shorter and broader. *Rh. pachycerus* Emery of Alto Paraná has 9-jointed antennæ, the scapes do not reach

the posterior corners of the head and the apical borders of the mandibles are very oblique. The worker of this species measures 2.2 mm. and is therefore larger than *parvidens*.

74. **Rhizomyrma dubitata** sp. nov.

Male. Length 2 mm.

Very similar to the male of *Acropyga*. Head a little broader than long, subrectangular. Eyes rather small, less than half as long as the sides of the head. Mandibles slender, distinctly tridentate. Clypeus convex and almost carinate in the middle, with entire, rounded anterior border. Antennæ with long scapes, which reach well beyond the posterior corners of the head; first funicular joint globular, as broad as long, joints 2–7 a little broader than long, remaining joints longer. Thorax robust but not much broader than the head through the eyes. Mesonotum convex in front, slightly overarching the pronotum; scutellum not convex; epinotum rounded, sloping, without distinct base and declivity. Petiole with erect node, which is rather thick though compressed anteroposteriorly, with a blunt, rounded, entire border. Its anterior face in profile is slightly convex, its posterior face more flattened. Gaster rather short and stout; external genital valves large, with broad, bluntly bidentate tips; inner valves shorter, unciform. Wings rather large, like those of *Acropyga* with one cubital cell, no discoidal cell and the radial cell closed.

Body shining throughout and very finely shagreened.

Hairs pale, erect, absent on the thorax and anterodorsal portion of the gaster, conspicuous on the petiole, venter and genitalia. Pubescence whitish, fine and rather dense, but not concealing the shining surface.

Yellow throughout; appendages scarcely paler; only the ocellar triangle blackish or fuscous. In some specimens the body is very slightly tinged with brown. Wings yellowish gray, with colorless veins and stlgma.

Described from numerous specimens taken by Mr. Aug. Busck in the San Francisco Mts. of San Domingo. This may be the male of the preceding species or of *Rh. smithi* Forel, but as it was not taken with workers and as it is the first male of the genus to be recorded, we deem it advisable to describe it under a new name. Specimens of *Rhizomyrma* are rare in collections. The species, as shown by their pale yellow color and the vestigial eyes of the workers, are evidently hypogæic and attend root-coccids like the species of *Brachymyrmex* and *Acanthomyops*. At least these are the habits observed in one of the South American species (*Rh. goeldii*).

75. **Camponotus maculatus** *Fabricius* subsp. **plombyi** subsp. nov. (Fig. 19.)

Worker major. Length 10–11.5 mm.

Head moderately large, longer than broad, somewhat broader behind than in front (3.5 mm. long, 3 mm. broad), with slightly excavated posterior border, rather angular posterior corners and feebly and uniformly convex sides. Mandibles long, 7-

toothed. Lobe of clypeus short, slightly projecting on the middle, angular on the sides. Antennal scapes extending fully one third their length beyond the posterior corners of the head. Thorax long, slender and low; pronotum more than half as broad as the head; base of the epinotum about twice as long as the declivity, the angle between the two rounded and indistinct. Petiole small, its anterior surface convex, its posterior surface flattened, its border rather sharp. Hind femora not compressed, without a row of graduated bristles on the flexor surfaces of the tibiæ.

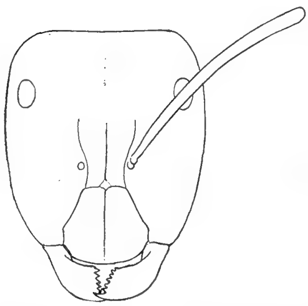

Fig. 19. *Camponotus maculatus* Fabricius subsp. *plombyi* subsp. nov. Head of worker major from above.

Shining and finely shagreened; mandibles, clypeus and head coarsely and rather sparsely punctate, the punctures becoming smaller and more scattered on the posterior portion of the head. Scapes opaque. Thorax and gaster with scattered piligerous punctures; scapes and legs with more numerous punctures.

Hairs fulvous, rather coarse, erect, not only on the body, but also on the scapes, short on the latter, the mandibles, cheeks, clypeus and upper surface of the head, long and more abundant on the thorax, petiolar border and gaster, very short and suboblique on the legs.

Black; mandibles, except their teeth, anterior half of clypeus, funiculi, tibiæ, knees and tarsi, dark red; gastric segments narrowly margined behind with sordid yellow.

Worker minor. Length 8–9 mm.

Head somewhat less than twice as long as broad, a little broader in front than behind, with straight sides, rounded posteriorly, the occipital border being short and feebly concave. Mandibles and clypeus similar to those of the worker major. Antennæ slender; scapes extending one half their length beyond the posterior border of the head. Thorax and gaster slender; base of epinotum very feebly concave in profile. Petiolar node thicker and blunter than in the worker major. Sculpture, pilosity and color much as in that phase, but the punctuation of the head much feebler. Legs somewhat paler in some specimens, the femora and coxæ being dark brown or reddish.

Described from a number of specimens taken in the mountains at Furcy, living in crater nests in the ground. This subspecies which is dedicated to the genial Abbé Plomby, closely resembles the subsp. *dominicensis* Wheeler from the island of Dominica in sculpture, pilosity and form, but the color is very different, the head of the major worker is decidedly shorter and the anterior border of the clypeus projects somewhat in the middle, where it is very feebly and sinuately notched.

76. **Camponotus maculatus** *Fabr.* subsp. **haytianus** subsp. nov. (Fig. 20.)

Worker major. Length: 11–12 mm.

Head large, subtriangular, a little longer than broad (4.3 mm. long, 4 mm. broad), much narrower in front than behind, with broadly and rather deeply excised posterior

border, prominent posterior corners, and rather straight sides. Mandibles long, convex at their tips, 8-toothed. Clypeal lobe rather long, its median border transverse, straight or very feebly sinuate its corners blunt and rounded. Antennæ slender, their scapes curved and extending less than one third their length beyond the posterior corners of the head. Thorax rather slender, and low, through the pronotum about one half as broad as the head. Epinotum long, base in profile straight or very feebly convex, about twice as long as the declivity into which it passes through a rounded, obtuse angle. Petiolar node in profile cuneate, thick at the base, rather pointed at the summit, with very feebly convex anterior and posterior surfaces; seen from behind its margin is rounded and bluntly pointed in the middle. Posterior tibiæ not compressed and not bearing a row of graduated bristles on their flexor surfaces.

Shining and very finely shagreened; mandibles opaque and finely granular at the base, with only a few scattered, coarse punctures along the dental border. Cheeks, clypeus and front without coarse punctures and the piligerous punctures

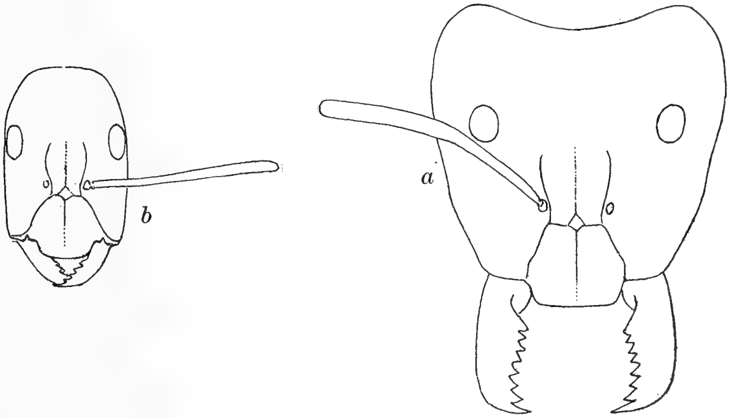

Fig. 20. *Camponotus maculatus* Fabr. subsp. *haytianus* subsp. nov. a, head of worker major from above; b, head of worker minor from above.

covering these and other portions of the body very small and sparse. Meso- and epinotum subopaque.

Hairs yellow, erect, sparse; long on the body, shorter but very conspicuous on the scapes and tibiæ; those on the mandibles very short; cheeks altogether without hairs.

Head dark blackish brown; mandibles, antennæ, clypeus and front dark red; thorax and gaster yellow, the mesonotum and in some specimens also the pronotum and epinotum, but to a less extent, infuscated. Each gastric segment with a broad, not very sharply defined, brown band across its posterior half; tibiæ and tarsi slightly reddish.

Worker minor. Length 7–9 mm.

Head a little more than $1\frac{1}{2}$ times as long as broad, very slightly broader in front than behind, with straight sides and the postocular portion rather short and semicircular behind, with short, concave occipital border. Antennæ very slender, their scapes reaching about one half their length beyond the posterior corners of the head. Thorax and petiole similar to those of the worker major.

In sculpture, pilosity and co'or s m:lar to th: worker major, but the mand:bles, clypeus, cheeks and front more yellowish.

Described from numerous specimens taken from nests in the soil at Di-quini and Port au Prince. This is a very interesting subspecies, easily distinguished from our other North American forms of *maculatus* by the large, triangular head of the worker major. In this character it closely resembles many of the Old World subspecies.

77. **Camponotus maculatus** *Fabr.* subsp. **fraterculus** subsp. nov. (Fig. 21.)

Worker major. Length 8–9 mm.

Differing from the preceding subspecies in its smaller size, more coarsely shagreened surface, in having the short hairs covering the dorsal surface of the head and the cheeks more numerous and the surface more punctate. The antennal scapes bear very few erect hairs and those on the tibiæ are shorter, less abundant and much more appressed. The head is brown, with the posterior corners, posterior border and clypeus, except its borders, brownish yellow; cheeks and vertex darker brown or blackish. Pro-, meso-, and epinotum each with a large brown or blackish patch above, that on the pronotum enclosing two elliptical yellow spots. The transverse bands on the gaster are darker and more sharply defined than in *haytianus*. The antennal scapes are dark brown, the funiculi brownish yellow.

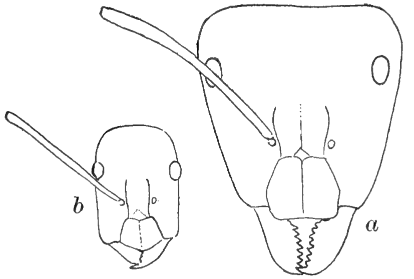

Fig. 21. *Camponotus maculatus* Fabr. subsp. *fraterculus* subsp. nov. a, head of worker major from above; b, head of worker minor from above.

Worker minor. Length 5–6.5 mm.

Yellow nearly throughout, the vertex of the head in some specimens slightly infuscated. Legs and scapes with very fine, dense, appressed pubescence; scapes also with a few scattered, erect hairs.

Described from numerous specimens taken at Furcy where they were nesting in the same stations and in the same manner as the specimens of the subspecies *plombyi* described above.

78. **Camponotus maculatus** *Fabr.* subsp. **soulouquei** *Forel.*

Forel, Mitth. Naturh. Mus. Hamb., XVIII, 1901, 2. Beih. p. 68, ☿.

Worker major (after Forel). Length 6.8 mm.

Similar to *C. ustus* Forel in external appearance, but the head much shorter, more triangular, broader behind, narrower in front, less shining. On the other hand,

very close to the subsp. *toltecus* Forel, but somewhat smaller, with somewhat more vivid coloration and with distinct, more abundant, short, yellowish, suberect hairs on the antennal scapes, and on the flexor surfaces of the tibiæ with oblique hairs, which are lacking in the subsp. *toltecus*. Scapes brownish red (brownish black in *toltecus*). The cheeks are hairy in both subspecies. In *C. soulouquei* the epinotal declivity is more distinctly marked off from the base. The clypeal lobe is also less distinct, more trapezoidal. The head is yellowish behind and below, above and in front brownish or reddish, the mandibles slightly shining, very finely reticulate and sparsely punctate (rather shining in the subsp. *toltecus*).

Female. Length 11.2 mm. The gaster has a dark brown transverse band on each segment. In other respects like the major worker. Legs yellow, tarsi, especially on the posterior legs, darker. Wings yellowish, with pale veins and stigma.

Gonaives, Haiti, May 10, 1894 (H. Nepperschmidt).

We are unable to recognize this subspecies among the material collected by the junior author.

79. **Camponotus fumidus** *Roger* var. **illitus** var. nov. (Fig. 22.)

C. fumidus var. Emery, Zool. Jahrb. Abth. f. Syst., VII, 1893, p. 670, ☿.

C. fumidus Dalla Torre, Catalog. Hymen., VII, 1893, p. 232.

Worker major. Length 8–9 mm.

Closely resembling *C. fumidus* var. *festinatus* Buckley of Texas, except in the following particulars: The antennal scapes are somewhat shorter and are covered with abundant, short, suberect hairs and the hairs covering the upper surface of the head, thorax and gaster are also more abundant. The scapes are red instead of

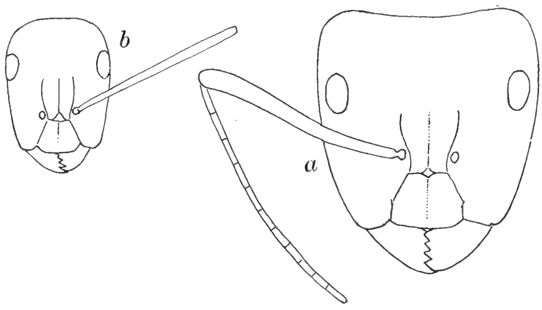

Fig. 22. *Camponotus fumidus* Roger var. *illitus* var. nov. a, head of worker major from above; b, head of worker minor from above.

black, and the tibiæ and tarsi are darker. The head is brownish yellow, the vertex with an elongate, well-defined, dark brown spot, which sends off a dark line to each eye. In some specimens the cheeks, too, are brown or reddish.

Worker minor. Length 6–7 mm.

Head distinctly shorter than in *festinatus* and distinctly narrowed in front, whereas in the Texan form the head is as broad in front as behind. Antennal scapes pilose as in the worker major and the hairs on the body somewhat more abundant than in *festinatus*. Whole body yellow, except the mandibles and edge of clypeus, which are red.

Described from several specimens taken from nests in the ground at Port au Prince, Diquini and Grande Rivière. There seems to be little doubt that this is the form regarded by Emery as a variety of *fumidus.* The true *fumidus,* originally described from Venezuela, has not since been observed, so that the Texan and Haitian forms have, perhaps, only a provisional status as varieties.

80. **Camponotus fumidus** *Roger* var. **imbecillus** var. nov.

Worker major.

Allied to *C. fumidus* var. *fragilis* Pergande, but differing in the following characters: The head is shaped as in the vars. *illitus* and *festinatus* and is distinctly broader than in *fragilis* and bears on the vertex a dark brown spot which is absent in this variety. The yellow color of the body and especially of the head is darker and more reddish, and the brown bands on the gaster are darker and more sharply defined. The suberect hairs on the antennal scapes are about equally abundant in both varieties, the hairs on the body are more abundant in *imbecillus.*

Worker minor. Indistinguishable from the corresponding phase of *fragilis.*

Described from four major and four minor workers taken at Grande Rivière. These have been compared with cotypes of *fragilis* received from Mr. Pergande by the senior author several years ago.

81. **Camponotus larvigerus** sp. nov. (Fig. 23.)

Worker major. Length 7.5–8.5 mm.

Belonging to the *maculatus* group and related to *C. ramulorum* Wheeler. Head moderately large, as broad as long, considerably broader behind than in front, with broadly excised posterior border and convex sides. Eyes flattened. Mandibles rather short, convex, with 7 subequal teeth. Clypeus sharply carinate, its border

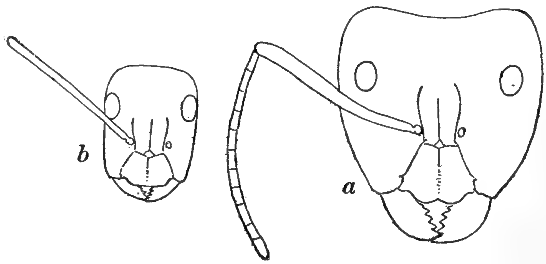

Fig. 23. *Camponotus larvigerus* sp. nov. a, head of worker major from above; b, head of worker minor from above.

very slightly projecting, divided into two short, equal, rounded lobes by a distinct but narrow median notch. Frontal area small, distinct. Frontal carinæ sigmoidal, as closely approximated behind as in front. Vertex with three distinct, pit-like impressions simulating ocelli. Antennal scapes curved, somewhat flattened towards

their tips, extending about one third their length beyond the median posterior border of the head. Thorax through the pronotum nearly two thirds as broad as the head, laterally compressed in the meso- and epinotal regions, in profile evenly arched above; epinotum with distinct base, and declivity, the latter distinctly concave, more than half as long as the base. Petiolar node compressed anteroposteriorly, not thick at the base, as high as the epinotal angle, its anterior surface slightly convex, its posterior surface flattened, its border moderately rounded and entire when seen from behind. Fore femora incrassated; hind tibiæ not compressed, without a row of graduated bristles on their flexor surfaces.

Shining throughout and very finely shagreened. Mandibles, clypeus and dorsal surface of head with small, uniform, shallow punctures.

Hairs yellow, sparse, present on the upper surface of the head, clypeus, thorax, petiole and gaster, absent on the cheeks and sides of the head. Scapes on their anterior surface and at their tips with a few short, erect hairs. Legs without hairs except at the tips of the femora. Pubescence very short and sparse, visible only on the gaster.

Mandibles, clypeus, gula and head dark brown or black; posterior corners and posterior border of head light yellow. Antennal scapes dark red, infuscated distally; funiculi brownish yellow. Thorax, petiole, gaster and femora yellow; mesonotum, upper portion of epinotum and pronotum dark brown, the latter in its dark area with two large, elliptical yellow spots, which are sometimes confluent with the yellow on the pleuræ. Gaster with a well-defined, broad, transverse, dark brown band on each segment. Tibiæ and tarsi reddish.

Worker minor. Length: 5.5–6.5 mm.

Head somewhat more than $1\frac{1}{2}$ times as long as broad, as broad in front as behind, with straight sides and short, rounded postocular region. Clypeus with entire, broadly rounded and rather projecting anterior border. Antennæ slender, scapes not enlarged distally, extending about one half their length beyond the posterior border of the head. Thorax slender, base of epinotum twice as long as the declivity. Petiolar scale less compressed anteroposteriorly than in the major worker, broader at the base and more cuneate in profile.

Sculpture and pilosity much as in the major worker but head impunctate and antennal scapes without erect hairs.

Color yellow, except the mandibles and tarsi, which are red.

Female. Length 9.5–10.5 mm.

Resembling the major worker but the head much narrower, longer than broad, with straight sides and the clypeus with its median border straight and transverse in the middle and angulate at the sides. Thorax narrow, the epinotum with convex base, which is about half as long as the abrupt, feebly concave declivity. Petiole as in the major worker.

Sculpture and pilosity much as in the major worker. Head with the yellow of the posterior corners extending forward and enclosing the eyes and front, and the anterior portion of the clypeus also yellowish. The brown of the remaining portions paler than in the worker major. The thorax is pale yellow, with restricted clouds of dark brown on the mesonotum, scutellum and epinotum. Wings yellowish, with pale yellow veins and stigma.

Described from numerous specimens taken from two colonies at Grande Rivière. At first sight this species would seem to be merely a small sub-

species of *maculatus*, but if it were reduced to this rank, *C. ramulorum* Wheeler and *ustus* Forel would also have to be regarded as subspecies of *maculatus*. From *ramulorum*, *larvigerus* differs in its larger size, the shape of the clypeus in the major worker and the peculiar coloration and more pronounced punctuation of the head in this phase.

82. **Camponotus ustus** *Forel.*

Bull. Soc. Vaud. Sc. Nat., XVI, 1879, p. 75, ☿ ♀ ♂; Mitth. Naturh. Mus. Hamb., XXIV, 1902, 2. Beiheft, p. 11, ☿ ♀.

The types of this species came from St. Thomas. It is also recorded by Forel from Port au Prince, Haiti, and we have before us a major worker received from Forel and taken in that locality by Mr. G. Keitel. It agrees very closely with Forel's description but the erect hairs on the scapes are more abundant. The whole upper surface of the head, including the cheeks, is hairy and the tibiæ have short but distinct hairs. The brown on the head is not very deep nor sharply defined, and the same is true of the transverse bands on the gaster. The specimen measures about 6 mm. All of the specimens collected by the junior author differ from this specimen, and represent the three following varieties.

83. **Camponotus ustus** *Forel* var. **ulysses** *Forel.*

Mitth. Naturh. Mus. Hamb., XXIV, 2. Beiheft, 1907, p. 11, ☿ ♀ ♂.

Worker major (after Forel). Length 7 mm.

Somewhat larger than the type of the species. Head broader and shorter. Epinotum forming a single arc, whereas in *ustus* (typical) it is higher and has a distinct basal and declivous surface. The sculpture is more sharply reticulate, especially on the head, so that the surface is less shining. The gaster has brown bands which are sharply marked off from the yellow ground color (in the typical *ustus* the bands are more diffuse).

Female. Length 10.5 mm.

Differing from the type in the same characters as the worker major. Head feebly shining or only lustrous (strongly shining in the type of the species), with distinct, scattered, coarse punctures. Epinotum less cuboidal. The wings are yellowish (in the type of the species nearly colorless). The brown bands on the gaster are very sharply defined.

Male. Length 7 mm.

Unusually large, gaster without transverse bands. Less shining than the type of the species. In other respects scarcely distinguishable except by the more yellowish tint of the wings. It belongs, at least very probably, to this variety.

Isla de Cabrilos in Lake Assuei and Port au Prince (G. Keitel); the male from Port au Prince.

It seems to us very probable that the male does not belong to this variety but to some one of the subspecies of *maculatus* described above. We refer to this variety several series of workers from Grande Rivière, Cape Haitien, Petionville, Ennery, Manneville and Port au Prince. All the specimens agree well with Forel's description except that the head and mandibles of the worker major are more shining and the thorax is slightly clouded with fuscous. The cheeks and scapes bear short, erect hairs but fewer than in the true *ustus*, apparently. In the minor workers the cheeks are naked and the scapes bear only a very few, scattered, suberect hairs.

84. **Camponotus ustus** *Forel* var. **sublautus** var. nov.

Worker major. Length: 6.5–7.5 mm.

Differing from the typical *ustus* and the var. *ulysses* in having no erect hairs on the cheeks and sides of the head, or even oblique hairs on the tibiæ, and the hairs on the body are much less abundant. The scapes are either naked or have only 3 or 4 erect hairs on their anterior surfaces. The coloration of the head is much like that of *C. fumidus* var. *illitus*, the cheeks, a large rectangular spot on the vertex, connected with each eye by a transverse line, being light or dark brown, while the remainder of the head, clypeus and front are brownish yellow. The punctures on the cheeks are small and superficial, the head and mandibles are more shining than in *ustus* and its var. *ulysses*. The epinotum is distinctly angular, with subequal base and declivity, the former feebly convex, the latter feebly concave. The brown bands on the gaster are faint and poorly defined as in the true *ustus*.

Worker minor. Length 5–6 mm.

Head subrectangular, only 1½ times as long as broad, as broad in front as behind, with straight sides, straight posterior border and rounded posterior angles. Antennal scapes reaching about half their length beyond the posterior corners of the head. Thorax shaped much as in the major worker. Pilosity and sculpture very much as in the latter phase, but the scapes are always without erect hairs. Pale yellow throughout, except the mandibles, which are reddish.

Described from several specimens taken at Diquini.

85. **Camponotus ustus** *Forel* var. **furnissi** var. nov.

Worker major.

Differing from the preceding variety in the color of the head, which is yellow throughout, except for an elongate, subquadrate brown blotch on the vertex extending forward somewhat between the frontal carinæ. The mandibles are red and somewhat paler than in the var. *sublautus*. In other respects like that variety.

Worker minor.

Distinguishable from the worker minor of *sublautus* only by the mandibles, which are pale yellow like the remainder of the body.

Female (deälated). Length 9.5 mm.

Colored like the worker major, except that the brown transverse bands on the gaster are darker and more sharply defined.

Described from several workers and a single female taken from two colonies, one at Petionville, the other at Manneville. The two new varieties described above, which are clearly intermediate between the typical *ustus* and *C. ramulorum* Wheeler of the Bahamas and Cuba, show that the latter form can hardly be maintained as a distinct species, but should more properly be regarded as a subspecies of *ustus*. The worker major of the typical *ramulorum* is distinguished from the *ustus* forms by its smoother and more shining surface, impunctate head and the brighter, deeper and more sharply outlined brown markings, which extend also to the thorax. The pilosity is even sparser than in the vars. *sublautus* and *furnissi*, and the legs and body are without traces of pubescence and the scapes are quite naked.

The whole series of forms described in the preceding paragraphs, including *larvigerus, fumidus, ustus* and *ramulorum* and their varieties form a compact group of closely allied forms which, were it not for unduly complicating matters, one might be tempted to attach to *maculatus* as so many subspecies or varieties, since they all differ from one another merely in minor morphological characters and in pilosity and coloration. The coloration, especially of the head and gaster, shows curious similarities in all the forms.

86. **Camponotus sexguttatus** (*Fabricius*).

Formica sexguttata Fabricius, Ent. Syst., II, 1793, p. 354, ☿.

A female, a worker minor and three males belonging to the typical dark form of this species, taken in the San Francisco Mts. of San Domingo by Mr. Aug. Busck.

87. **Camponotus claviscapus** *Forel* subsp. **occultus** subsp. nov. (Fig. 24.)

Worker major. Length 5.5–6.5 mm.

Differing from the typical *claviscapus* of Trinidad and its var. *subcarinatus* Forel of Central America in its somewhat smaller size, in having the sides of the clypeus more nearly straight and parallel and the punctures on the mandibles, clypeus, cheeks and front denser and larger, so that these portions of the head are nearly subopaque. The base and declivity of the epinotum meet at nearly a right angle, which is blunt but distinct, the declivity being concave. The thorax is uniformly yellow throughout, as is also the posterior border of the head, and the brown bands on the posterior borders of the gastric segments are nery narrow.

Worker minor. Length 4–5.5 mm.

Differing from the worker of the typical form in having the clypeus distinctly carinate and in the paler color of the body, which is yellow throughout, with the head a little darker and more reddish and without brown bands on the gaster.

Female (deälated). Length 7 mm.

Closely resembling the major worker but the head proportionally shorter and smaller. The thorax is elongate elliptical, its upper surface very smooth and shining. The body is pale yellow, the head slightly but uniformly reddish, much paler than in the worker major, the mandibles dark red, the gaster with a distinct transverse brown stripe near the posterior border of each segment. The female of the var. *subcarinatus* has the head and gaster much darker and even the thorax tinged with brown.

Male. Length 3.5–4 mm.

Differing from the male of the typical *claviscapus* and its var. *subcarinatus* in its smaller size and pale color. The whole body is pale yellow and there are no brown bands on the gaster. The wings are nearly colorless, with very pale yellow veins and stigma.

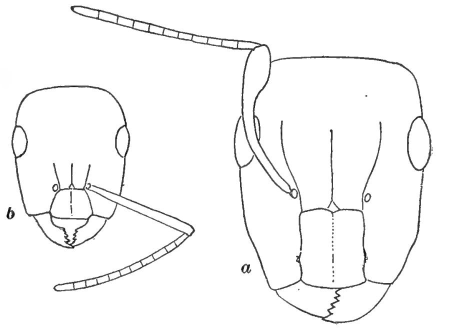

Fig. 24. *Camponotus claviscapus* Forel subsp. *occultus* subsp. nov. a, head of worker major from above; b, head of worker minor.

Described from several workers, two males and one female taken from hollow twigs and bamboo at Petionville, Diquini, St. Marc and Port au Prince. This form should, perhaps, rank as a distinct species. We have not seen typical specimens from Trinidad although we have compared the Haitian form with large series of all four phases of the var. *subcarinatus* taken by the senior author in Costa Rica and Guatemala and with a number of workers of a form which if not identical with, is nevertheless very close to, the typical *claviscapus*, collected by the junior author in Brazil.

88. **Camponotus christophei** sp. nov. (Figs. 25 and 26.)

Major worker. Length 5–6 mm.

Head rather large, subtrapezoidal, seen from above as broad as long, broadest behind, with rather straight posterior border and rectangular posterior corners, each with a sharp ridge running to the eye, the sides flattened behind and below this ridge, the cheeks rather convex. In profile the head is convex above and below, with elliptical, rather large, flattened eyes situated behind its median transverse diameter. Mandibles small, very convex, 5–6-toothed. Clypeus flat, indistinctly carinate, its anterior border sinuately excised in the middle. Frontal area obsolete. Frontal carinæ curved, but rapidly diverging behind where they are fully twice as far apart as in front. Frontal groove absent. Antennæ slender, scapes curved, but slightly enlarged towards their tips, which extend a little beyond the posterior corners of the head. Thorax short, flattened above and on the sides, the pronotum less than twice as broad as long, broader in front where it is a little narrower than the head, rounded and produced in the middle anteriorly over the neck, with each side expanded into a sharp, aliform plate, which is slightly reflected. Its outline

seen from above is slightly rounded and produced at the anterior corner as a distinct triangular tooth. Promesonotal suture very distinct, meso- and epinotum fused to form a single mass which is about as long as, but much narrower than the pronotum; the mesonotum trapezoidal, less than twice as broad as long, strongly marginate on the sides which are straight and separated from the base of the epinotum by a straight, transverse ridge, instead of the suture, which is absent. Epinotum very short, high in profile, with very abrupt, slightly concave declivity and extremely short, feebly convex base, the two surfaces forming a distinct angle with each other. Petiole nearly as broad as the epinotum behind, but its scale much lower than the base of the epinotum, much compressed anteroposteriorly, with rather sharp, broadly rounded superior border. Gaster oval, broader in front than behind, distinctly flat-

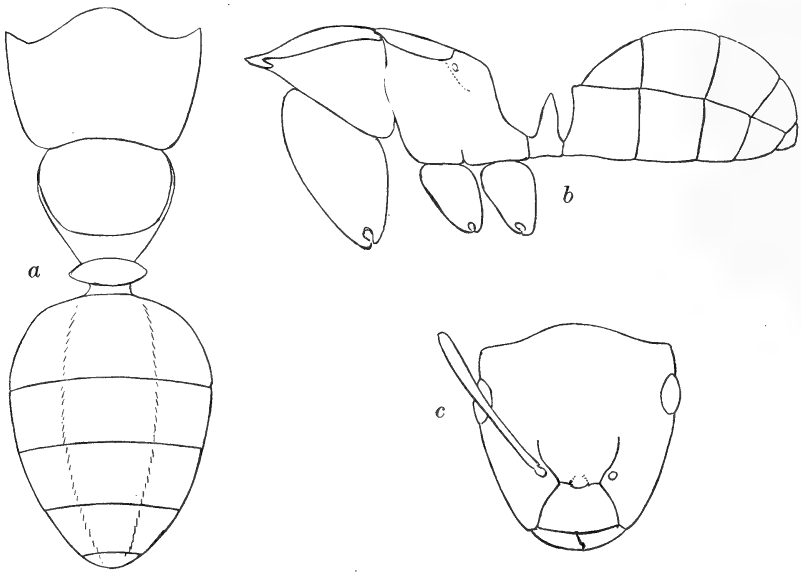

Fig. 25. *Camponotus cristophei* sp. nov. Worker. a, dorsal view of body; b, profile of body; c, head from above.

tened dorsoventrally, the first segment sharply marginate anteriorly. Legs rather stout.

Opaque; head and thorax very densely and uniformly punctate; sides and posterior portion of head and the pleuræ also finely and regularly longitudinally rugulose. Gaster with a velvety texture produced by extremely fine and dense shagreening. Posterior margin of head, mandibles and anterior surfaces of fore legs shining.

Hairs white, coarse, blunt, suberect, most abundant on the upper surface of the head, pro- and mesonotum, base of epinotum and border of petiole; sparser on the gaster, appressed on the pleuræ. Flexor borders of femora with a fringe of similar hairs. Pubescence white, appressed, short and coarse on the body and the legs, except on the upper surface of the gaster, where it is long and aggregated on each side to form a broad yellowish white band, which tapers anteriorly and posteriorly. On the venter there are two patches of similar appressed pubescence, but shorter

and less dense. The pubescence on the remainder of the gaster is even shorter and sparser than on the head.

Black; antennae light red; mandibles and last tarsal joints dark red; angles of pronotum brownish, somewhat translucent.

Fig. 26. View in the Citadel of Cristophe where *Camponotus cristophei* sp. nov. was taken.

This very beautiful species, which, with the two following forms is related to *C. saussurei* Forel, is described from four specimens taken near Milot on blades of a tall grass outside the citadel of Henri Christophe, former king of Haiti and also running about on the stone-work inside the fortification.

89. **Camponotus christophei** subsp. **augustei** subsp. nov.

Worker major. Length 5–6 mm.

Closely resembling the preceding species in form, sculpture, pilosity and color but differing in having the petiole somewhat broader and in completely lacking the two pale bands of long appressed pubescence on the gaster.

Worker minor. Length 4.5–5.5 mm.

Differing from the major worker in its somewhat smaller average size, smaller head, slightly narrower thorax, less convex and more sloping epinotum, and narrower and less reflected and less angular pronotal borders. The gaster is covered uniformly with short, sparse, blunt, white pubescence, like that on the head and thorax.

Described from six major and four minor workers found running about on leaves at Petionville. The minor workers show conclusively that the specimens have not lost white bands through rubbing. This subspecies is dedicated to the late president of Haiti, M. Tancrède Auguste.

90. **Camponotus toussainti** sp. nov. (Fig. 27.)

Worker minor. Length: 4–5 mm.

Head trapezoidal, as broad as long, broader behind than in front seen from above, with evenly and feebly convex posterior and lateral borders; each posterior corner connected with the eye by a distinct ridge. Mandibles small, convex, apparently 4–5-toothed. Clypeus flattened, ecarinate, trapezoidal, its anterior border not produced, sinuately notched in the middle. Frontal area and groove absent. Antennæ rather slender, scapes feebly enlarged at their tips and extending a litte beyond the posterior corners of the head. Thorax short, with distinct promesonotal but no mesoëpinotal suture, feebly arcuate in profile, flattened on the sides. Pronotum broad, subpentagonal, broader in front than behind, its median anterior border produced as a rounded angle over the neck, its sides expanded as aliform, feebly reflected plates, bluntly rectangular in front and behind. Mesonotum much narrower

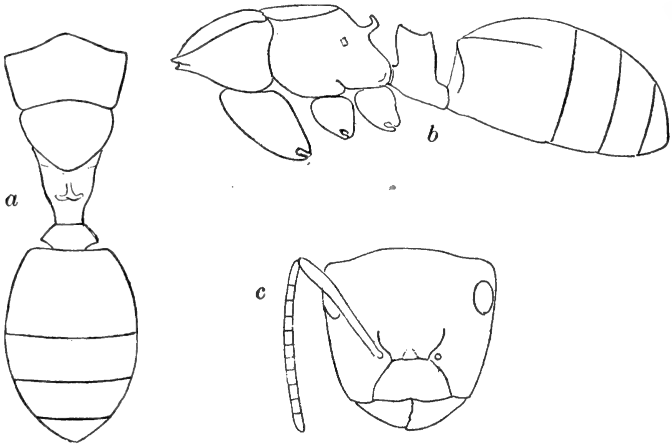

Fig. 27. *Camponotus toussainti* sp. nov. Worker. a, dorsal view of body; b, profile of body; c, head.

than the pronotum, subtriangular, as long as broad, its anterior border evenly rounded, its sides strongly margined and feebly rounded, meeting behind in a blunt, margined point where the mesoëpinotal suture should be located. Epinotum obliquely sloping, distinctly concave, bearing just above its center an unpaired process which is directed backward and upward and bifurcates at the tip to form two branches which are as long as the unpaired basal stem and slightly recurved and blunt at their tips. Petiole nearly twice as broad as long, broader than the epinotum, seen from above trapezoidal, broader behind than in front, its anterior border perfectly straight, transverse and margined, its sides also straight and sharply margined and forming perfect obtuse angles with the anterior border, behind continued into short, pointed teeth. The posterior border is rounded in the middle and sinuately excised on each side. The upper surface is flattened like the pro- and mesonotum. In profile the petiole is about as long as high, subcuboidal, a little higher in front than behind and thicker above than below. Gaster rather large, elliptical, somewhat flattened

dorsoventrally, the anterior and lateral borders of the first segment strongly marginate. Legs moderately stout, fore femora not incrassated.

Opaque throughout, densely and uniformly punctate, the punctures on the gaster being finer than those on the head, thorax and petiole, and the scapes and legs still more finely punctate. Pleuræ also feebly longitudinally rugulose.

Hairs and pubescence white; the hairs short, moderately coarse, pointed, erect and rather uniformly abundant on the head, thorax and gaster, shorter and oblique on the legs, absent on the scapes. Pubescence very coarse, long, appressed, silvery, conspicuous on the head, thorax and gaster but not dense. Scapes and funiculi covered with very short, fine, rather dense pubescence.

Black; antennæ, tibiæ and tarsi dark red.

Described from several specimens taken at Petionville and in the mountains north of Jacmel, running on leaves. The nests could not be found. This species, which is dedicated to the San Domingan patriot Toussaint L'Ouverture, is closely related to *C. saussurei* of St. Thomas, which Forel styled "le bijou du genre *Camponotus*," but the Haitian species is even more remarkable, because its petiole has such an extraordinary shape. The similarity between the two species is closest in the structure of the head and thorax as shown by comparison with Forel's description and figure (Études Myrmécologiques en 1879. Bull. Soc. Vaud. Sc. Nat., XVI, 1879, p. 103, fig. 3).

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Article II.—NOTES ON THE SEA ELEPHANT, *MIROUNGA LEONINA* (LINNÉ).

By Robert Cushman Murphy.[1]

Plates I–VII.

The following notes on the sea elephant (*Mirounga leonina*) are based mainly upon field studies made at the island of South Georgia during the Antarctic summer of 1912–1913. The term of 15 weeks during which the writer had these seals under observation, did not, unfortunately, include the period of the birth of the young, but some new facts were gathered concerning the sea elephant's feeding habits and activities during the æstivation following the breeding season.

History.

No attempt will be made in the present paper to summarize the results of earlier observations in the scattered literature of this interesting seal. The older records, relating to its presence and habits at Juan Fernandez, the Falklands, and Tristan d'Acunha where it has become extinct, are filled with speculation and seamen's lore; and later publications concerning the animal at Kerguelen Land, Heard Island, South Georgia, and other places where it still persists, do not give us by any means a complete knowledge of its range and life history.[2] *Mirounga leonina* has been styled in the vernacular the *Antarctic* sea elephant to distinguish it from the *Northern* or California species (*M. angustirostris*). It is doubtful, however, whether there is any record of the occurrence of a member of the genus within several hundred miles of the Antarctic Circle. The southern species, which may be of northern origin, is typically a resident of the lower South Temperate or sub-Antarctic belt.

At South Georgia the life history of the sea elephant seems to be somewhat as follows: The single "pups" are born on shore early in the spring and the adult seals pair immediately afterwards while the young are sucking. The adults then lie ashore for a time, moving little and of course feeding not

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[1] Curator, Division of Mammals and Birds, Museum of The Brooklyn Institute of Arts and Sciences.

[2] At the present time Major C. E. H. Barrett-Hamilton is at South Georgia conducting an investigation into the status of the sea elephant for the British Colonial Office. We may hope, therefore, that our knowledge of the species will soon be further extended, especially with regard to breeding habits and migrations.

at all, while they become gradually thin as their metabolism consumes the blubber layer. The young are more active, frequently entering the water and playing with one another, particularly at night. After eight or ten weeks most of the adults go into the sea where they feed and make journeys of unknown extent. A few continue ashore through the summer for I have seen greatly emaciated males lying in back-beach wallows, either alone or with several females, as late as March first. Most of the pups leave the beaches during January. The return to the land of rejuvenated, fat sea elephants begins, according to my observations, in January, and continues for two or three months. March, which corresponds to the northern September, is the month in which seal hunters consider that the most profitable animals are to be found on shore. After having "hauled up" the sea elephants congregate in herds, usually behind the open beaches, and lie in sleepy ease throughout the remainder of summer and the autumn. During the winter (May–September) they are said to divide their time between the land and the adjacent waters, and are in exceedingly well nourished condition when they come ashore to remain for the breeding season in the spring.

Seasonal Movements.

The area of field work at South Georgia included the shores of four large fiords on the northeastern seaboard — Cumberland Bay, Antarctic Bay, Possession Bay, and the extensive Bay of Isles. Six weeks were spent at the last named place, which in its isolated position, accessible beaches, and grassy islands offers an excellent summer habitat for sea elephants.

During the latter part of November and all of December the groups of sea elephants encountered comprised animals in every stage of growth. On December 3, for instance, we found on a beach near Nordenskjöld Glacier, Cumberland Bay, a large herd which included a nursery of fat pups about a meter and a half in length, a few yearlings and half grown animals, and many adults wallowing in a muddy stream, the females close beside a few of the larger males. None of the adults were extremely fat, and the males, in particular, appeared to have scanty blubber and loose skins. On December 15 at the Bay of Isles we found similar conditions, except that there were then fewer fully adult animals in proportion to the pups. Thereafter a rapid decrease in the numbers of old males and females on the beaches took place until January.

Sea elephants just out of the ocean are distinguishable at a glance from those which have lain long ashore, for the former are sleek, round, and obviously well fed, a deduction borne out by an examination of their stom-

achs. On January 4, at the Bay of Isles, I saw the first of these "newly hauled up" seals nearly all of which were females. Throughout the month they arrived almost daily, and a table of the population on various beaches during January may be of interest.

Number of Sea Elephants seen on the Beaches at Bay of Isles in January, 1913.

Locality in Bay of Isles.	Date January	Numbers of Seals	Sex, age, etc.
Shingle Beach	5	66	Mostly ♀♀ just from sea.
Sea Leopard Fiord	10	59	Mostly ♀♀ just from sea, 1 adult ♂ just from sea.
Beckman Fiord	11	84	42 ♀♀ just from sea, several thin, beach-lying ♂♂, the remainder pups.
Near Lucas Glacier	16	15	13 ♀♀ and 1 adult ♂ just from sea, 1 adult beach-lying ♂.
Sea Leopard Fiord	19	56	55 ♀♀ just from sea, 1 adult beach-lying ♂.
Beckman Fiord	20, 23 24	123	Mostly adult ♀♀ just from sea.
East of Grace Glac'er	26	24	Mostly ♀♀ just from sea, 1 pup came out on this beach today.
West of Grace Glacier	27	44	43 ♀♀ and 1 large ♂ just from sea.
South of Brunonia Glacier	29	70	67 adult ♀♀, 1 large ♂ and 2 half-grown ♂♂ just from sea.
Sunset Fiord	31	44	42 adult ♀♀, 2 very large and fat adult ♂♂ just from sea.

It will be observed from the foregoing table that by far the greater number of the earlier arrivals are females, a fact which perhaps may be explained in part as the result of human interference. The patriarchal bull sea elephants have been sporadically killed off by sealers at South Georgia for more than a century, and since 1908 they have been annually wiped out in all the fiords of the island by a sealing steamer of the Compania Argentina de Pesca. Of the hundreds of carcasses we saw on various beaches all but very few were those of fully grown males, and the disproportionate number of females at the end of the summer season is certainly due to this slaughter.[1]

[1] Six thousand males are said to have been killed during a single season. The result of this slaughter is showing itself in a way which points to the speedy extinction of the sea elephant at South Georgia, viz., very many illegally killed females, which I dissected during the summer, had not been impregnated. The present supply of males is therefore insufficient for the perpetuation of the species.

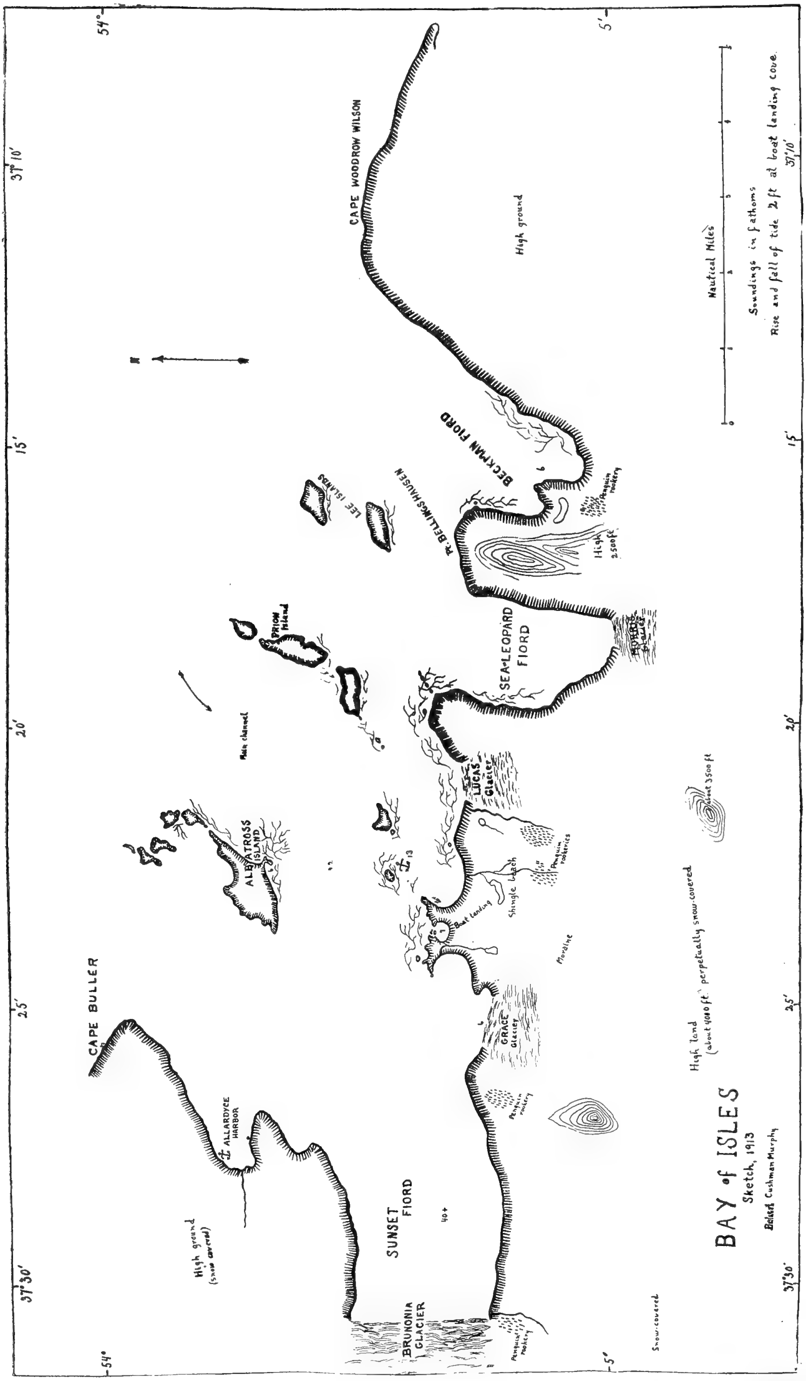

Fig. 1. Sketch map of the Bay of Isles, South Georgia, showing localities referred to on p. 65.

Few pup sea elephants were observed after the middle of January. By the end of the month large old males began to "haul up," and from that time they came out of the sea in increasing numbers until March. The largest number seen in one place was 25, observed on the eastern shore of Possession Bay on February 28.

Habits.

Although mixed herds of sea elephants were under observation throughout December, which corresponds to our June, I never saw a female suckling her young or giving any other indication of motherly ownership. Females dissected late in the month showed only slight traces of milk in the lacteal glands, so that it seems probable that the pups are weaned early in the season. The pups are tremendously fat during the spring, but they lose much of their plumpness before midsummer. They spend most of their time sleeping, lying in groups over the beaches, piled one upon another or resting close together on their sides or backs. Often while I walked among them and stepped over them they slumbered as though anesthetized, rarely stirring except to yawn or to scratch themselves with the nails of their flippers. A vigorous prod would arouse them, but after momentarily attempting to look ferocious by showing their ridiculous little peg-like teeth, and glaring fixedly with large, moist, brown eyes, they would fall back again with closed lids and a sigh of resignation. They did not object very seriously even to having their chins scratched. Sometimes they were seen to play with one another in a kittenish manner, and they appeared to move about considerably at night.

Adult sea elephants are instinctively ill-tempered, especially toward the end of the breeding season when they are thin and presumably hungry. They snarl even at such a familiar creature as a penguin if it chances to walk near them along the beach. When approached too closely the bulls rear up on their fore flippers, thrash about with their hinder parts, contract their trunks into tight, bulging folds, open their pink mouths to an angle equalled among all mammals only by the Pleistocene saber-toothed tiger, and finally utter their vocal expression of displeasure, which cannot be described by any single English word. This sound has usually been termed a "roar," but it has been compared more accurately with the noise made by a man gargling. The whole process appears extraordinarily painful. After the mouth has been opened to its greatest extent a rather long period of nearly noiseless choking ensues; then the volume of breath seems to squeeze past the epiglottis, the soft palate vibrates violently, and a spasmodic sound suggestive of both strangulation and nausea is produced. It is not a loud

sound yet it can be heard for a surprisingly long distance on calm nights. The voice of immature bulls is louder and more startling than that of the adults, being a cavernous, grating bellow with somewhat of a groan in it. The cows have rather soft "gargles," and also utter high pitched barks. The pups, too, bark, and sometimes wail almost like young children.

If a group of sea elephants is annoyed, for instance by being prodded and driven by sealers, they sometimes give way to an uncontrolled panic of passion, thrashing about blindly, biting the ground, running amuck and tearing the backs of all others within reach. Sealers have told me that they have seen bulls in such fits of fury actually lift a younger male or full grown female off the ground and toss it aside. When a man shouts and swings his arms in front of a bull sea elephant, vexing it until it has become thoroughly excited, its behaviour recalls a toy rocking-horse in motion, for the enraged seal commonly sways in a similar manner, first rising until its fore flippers are far above the ground, then rolling forward until the hind flippers are curved up over its back, but as a rule only rocking, without moving from its position. All the while the beast's blood-shot eyes are blazing with rage, the trunk is drawn up into a "bonnet" above the gaping mouth, the tusks gnash the ground as the animal strikes forward and downward, the whole expression of its emotion being truly hideous. Sea elephants can spin themselves around very quickly to meet an attack from the rear, and their surprisingly extensible necks give them a long and dangerous reach.

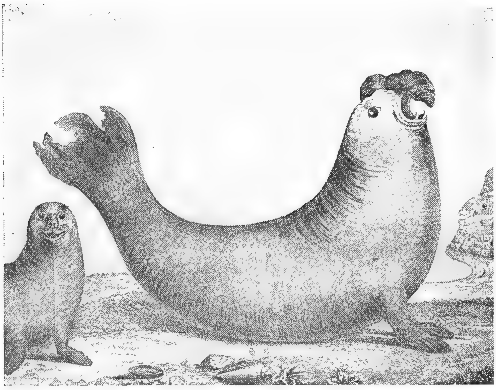

Fig. 2. "A Sea Lyon of Juan Fernandez." From Anson's Voyage. Compare with Fig. 24, Plate VI.

Generally their tactics with regard to human beings are wholly defensive. Indeed, barring rare exceptions, they regard a man with absolute indifference unless he comes within a few paces of them, the few shy individuals that take to the water at sight probably having vaguely unpleasant memories of sealers' cruelty. Now and then, however, and particularly during the rutting season, according to sealers, one meets a pugnacious or jealous bull which seeks trouble at every opportunity. On February 17, at the Bay of Isles, I watched in hiding an unusually large sea elephant come out

of the cove below my tent about noon and work its way up among the tussock hummocks. I wanted its skeleton, but unfortunately had left my rifle aboard ship. However, as soon as the lazy animal had found a berth to please it and had fallen asleep, I descended all unsuspectingly with a camera and a seal lance, and after making ready for a head-on snapshot I whistled to awaken the brute. The effect was greater than I had bargained for. It opened its eyes casually enough, but instantly on seeing me it rolled over with a snort, and bounced toward me so quickly that I had barely time to avoid the charge. Of course after that it was easy enough to dodge it among the hummocks where it was at a disadvantage, but nevertheless it continued for some time to bump along steadily after me, with homicide in its eye. Setting down the camera I attacked my pursuer with the lance, and the brute snorted and bellowed as it reared two or three feet above my head and hurled forward its tons of weight in an effort to crush me. Finally it headed for the water, but I succeeded in killing it before it could escape.

The fighting by means of which bull sea elephants obtain possession of the cows has been often described;[1] but the animals fight from other motives as well, or apparently from no motive at all. From my camp I frequently saw half grown bulls wake from peaceful naps and immediately start quarrels with near neighbors; and the youngest pups were quite as apt as their elders to rear and bump against each other, or to assume heroic poses and glare with infantile ferocity into one another's eyes. In the ordinary contests of the bulls, which seem to be of a purely calisthenic nature, the two champions meet closely and rear up until only the hinder part of the belly rests on the ground, and then hurl themselves one against the other, clashing their breasts and raking one another's thick-skinned necks with their heavy

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[1] It would seem curious that the accounts of polygamy and selective fighting among these seals should have been discredited by several recent writers. The common experience of sea elephant hunters has been that during the breeding season the larger bulls accumulate groups of cows which they defend desperately from the encroachments of other bulls, a successful lord of such a seraglio being termed a "beachmaster." (In this connection see Pl. VII, fig. 27). Anson (1748), writing of the bulls at Juan Fernandez, says: "One of them was the master of the flock, and from his driving off the other males, and keeping a great number of females to himself, he was by the seamen ludicrously styled the Bashaw." Although my observations, at South Georgia were made after the height of the breeding season had passed, I repeatedly saw single bulls lying apart with four or five cows, and I observed that whenever a rival approached such a group a fight was apt to be precipitated.

The account of the American sealer, Captain Fuller, (Forschungsreise S. M. S. "Gazelle," Theil III, Berlin, 1889) is worthy of consideration. Captain Fuller is said to have been born on a sealing vessel at Kerguelen Land, a distinction probably shared by no other human being, and in later life he voyaged frequently to that island in order to take sea elephant oil. He had unparalleled opportunities for learning the habits of these animals, and he has been generally credited with being "an unusually careful observer" (Bull. U. S. Nat. Mus., No. 2, 1875, p. 41). Captain Fuller's direct testimony concerning the polygamy of the sea elephants will require indubitable refutation before it may be disregarded.

lower canines, at the same time flinging their posteriors into the air. Occasionally they come to a clinch by pressing the sides of their necks together, and so take a breathing spell. All the motions are clumsy and lumbering; a good deal of threatening and sputtering occurs between the clashes, and sometimes they merely rise up on the toes of their fore flippers and stand rigidly, with heads held back and mouths wide open, until each collapses from weariness, without a blow having been struck. Thoroughly angry bulls, however, clamp jaws on their rivals, badly lacerating each other's pelts. I saw one large animal which had lost a good portion of the wall of the snout, and others with cicatrices which extended clear through the blubber layer on the shoulders. All but the youngest animals have faint spots distributed over the back, breast, and sides, which seem to be due to irregularities of the hair on small scars made by the teeth of their fellows.

Fondness for company is one of the sea elephant's marked traits. An animal coming out of the sea is obviously not contented on a lonesome shore. It wanders about nervously between brief resting periods and soon returns to the water, perhaps feeling that it *must* find someone to quarrel with. A sea elephant when landing crawls slowly up the strand, stopping to let the waves break over it and taking advantage of every swell to aid its progress. When it has reached the upper beach it rises to its full height and reconnoiters; then, proceeding a little further it repeats the action, or if it spies none of its kind it may take a siesta before continuing the search. A certain wind-swept beach plain, bounded by two glaciers and extending back more than a mile from the Bay of Isles, was a favorite place for sea elephants of all sizes to "haul up." The western end of this beach, below the site of my camp, was covered with hummocks of tussock grass and a dense growth of "Kerguelen tea" (*Acæna*), the other three-quarters being a stretch of fine shingle, nearly bare of vegetation, and enclosing four ponds or chains of ponds which were fed by some of the innumerable glacial streams that cross it. During December about 250 sea elephants were summering on various parts of this beach, and even after the sealers had sent these the sad way of their forefathers, whose bones lay scattered far and wide, others came up from time to time. When we first arrived, groups of the animals were occupying three different types of lairs, namely: 1, the depressions or troughs between the tussock hummocks; 2, grassy places on the banks of the streams and fresh-water ponds; 3, pockets of stagnant, fluid mud around the edges of a terminal moraine behind the shingle. Each cluster of sea elephants lay as closely together as possible during the daytime, and all the lairs had a strong swinish smell. The younger animals of the groups near the ponds entered the water more or less and indulged in many of their fights there; the animals in the mud-holes lay engulfed to the eyes and

seemed to wallow thus for days at a time. At night all were noisiest and most active, some roving about, for in the morning I often found their broad tracks winding across the pebbly plain and sometimes leading a mile away from the bay. On a level surface sea elephants can bob along faster than a man can walk, but pauses for rest are made at short intervals. Their mode of progression has been well likened to that of an inch-worm, yet when in a hurry they arch the spine and jerk forward the pectoral flippers with such rapidity that their resulting gait might almost be called a gallop. It is laughable to see a fat adult bounce along at full speed, with head jerking up and down and ponderous blubbery sides shaking. The hind flippers are of course not employed for travel on land, but are merely trailed. Although going up hill is necessarily a slow and painful process for sea elephants, they are nevertheless ambitious in that feat, especially on those parts of the coast where the best growths of tussock grass are on hillocks near the shore. East of Possession Bay is a lake which can be reached from the seaside only by a very steep climb, yet many young sea elephants were swimming in it. Not infrequently we found herds of the animals on the summits of promontories 70 or 80 feet above the sea, and in one instance much higher, atop a perpendicular cliff which the seals had surmounted from the rear by clambering up an adjacent valley. Later the seal hunters visited this place, and I was told that a stampeded cow had dashed over the brink of the cliff and had fallen more than a hundred feet to the beach below, yet she scurried right into the sea and swam away vigorously!

When in the water sea elephants remain submerged most of the time. Sometimes when offshore I have seen a bull thrust its great head out of the still bay, slowly revolve two or three times while replenishing its store of oxygen, and then quietly sink to be seen no more. When swimming they progress by means of wide sculling sweeps of the hind flippers, the lobes or blades of either limb working simultaneously and in parallel planes. Young pups make strong backward strokes with their fore flippers also, but the adults seem to do so only when sharply turning. It is astonishing to see with what ease their huge bodies glide through the dense thickets of the giant kelp, that longest of sea plants, whose submarine branches harbor a fauna more abundant than any inhabiting the forests of the upper world. I suspect that the sea elephants procure a part of their food among the tangles of the kelp, for I sometimes found small rubbery pieces of the seaweed in their alimentary tracts.

Notwithstanding the various activities I have described, sleeping, after all, seems to be the main business of sea elephants during the summer months. They sometimes take naps in the coves and ponds, either at the surface, with round backs just awash, or else down near the bottom, where they

maintain a perfect hydrostatic balance. Ashore they sleep most of the time, usually lying belly up, and they often refrain from breathing for considerable periods by keeping the nostrils tightly closed just as if they were under water. Still more often they make use of one nostril only, spreading and closing it with each breath, while the other remains shut all the time. A sea elephant's sleep is suggestive of nightmares or a guilty conscience. The inspirations of the breath are irregular gasps, the expirations tremulous wheezes. The body shakes violently from time to time, and the fore flippers are ever nervously moving about, now scratching the sides, now the head, which is inclined downward until within their reach; next they may be crossed over the breast in order that one flipper may be scratched by the other. The fingers of the flippers are very flexible, bending when employed in scratching quite like human fingers. The hind flippers are now and then spread fan-like, and brandished in the air, or are rubbed and clasped together like a pair of clumsy hands. Awake or asleep they are fond of flinging sand or mud over themselves by scooping the earth backwards with the palmar surface of the pectoral flippers. All these motions often go on while the brutes are in such total oblivion that it is difficult to awaken them. I have tossed a handful of sand into the wide open nostril of a restless, sleeping bull, throwing it into a fit of coughing, yet it did not even open its eyes. In December a group of nine half grown bulls, which I was careful not to alarm, lay sleeping beside a stream near my tent, and I believe none of them moved so much as its own length during ten days, although they roused up once in a while for pugilistic encounters, and made considerable noise.

Food.

Regarding the food supply of the sea elephant I made some interesting discoveries. The stomachs of animals which had lain on the land a long time were almost invariably filled with sand and gravel, and the sealers considered this an indication that these seals had been on the point of going to sea. In such cases all trace of food had disappeared excepting the hard, chitinous beaks of squid of which there were sometimes a hundred in a single stomach. Within the stomachs of animals killed as soon as they had come ashore, I found the remains of both squid and small fish. From one female I took fifteen fishes about 25 centimeters long, but which were so far triturated that I could not identify them. No other swallowed substances were found excepting salt water and bits of kelp which probably had been introduced accidentally. In many of the two hundred or more stomachs which I opened there was a quantity of mucilaginous secretion colored yellow or

green with bile pigments, and the stomachs of all but the young pups contained at least a few squid beaks. Every stomach without exception swarmed with parasitic nematode worms. Occasionally I found platyhelminths in the colon.

Pelage, Growth, Size, etc.

The sea elephant's hairy coat is close, short, and stiff. The pelage of the pups during the first season is blackish brown on the upper surface, and of a light creamy buff color below. When wet the ventral surface looks white, especially from a distance. After the first year the animals show a wide range in coloration, seemingly with slight regard to age, for gray, brown, and tawny adults are often seen in one group. Adult females are perhaps prevailingly grayish brown, and "brown cow" is a common term in the sealer's parlance. I noted a good many large bulls which were of a tan hue. However, the very oldest males seem to be invariably dark, and this is doubtless the stage quoted by Sir William Henry Flower (1881) as being "dirty blue-black," and by Professor Einar Lönnberg (1906) as "oily greenish gray." The shedding of the hair during the summer gives the animals a very ragged appearance. The season of this process is subject to individual variation, for I saw both males and females in every stage of the change from the end of November until March.

The growth of the pups is very rapid at first, those which I saw about the first of December averaging a meter and a half in length, or almost twice as much as a newly born animal which I found dead. The few pups seen toward the end of January were about two meters long, but others found in a fresh-water lake on February 26 were no larger.

Among the adults the disproportion in size between the sexes is much greater than with the California species of *Mirounga*, for out of more than a thousand females I saw none which exceeded three meters in length, whereas Townsend (1912) measured females of *M. angustirostris* at "eleven feet." [1] Most of the females I measured at South Georgia were less than 260 centimeters long.

Until the first of February I saw no living male more than four meters long, but thereafter five meter bulls were taken several times. On Febru-

[1] Harris, 'Pacific Monthly,' April, 1909, records a female of *M. angustirostris* which was "eleven feet, five inches" long.

Wilkes, Nar. U. S. Expl. Exp., 1845, records a female of the southern species taken on sea ice in lat. 65° 08′ S, long. 163° E, Jan. 14, 1840, as having been 10 feet 9 inches long, but this measurement may have been made along the curve of the back.

Lönnberg (1906) records a South Georgia female measuring 310 centimeters in length.

ary 28 the record sea elephant was killed in Possession Bay. I did not see this animal until it had been stripped of blubber, but in its flensed condition it measured 651 centimeters (21 feet 4 inches) in a straight line. Measurements of five smaller males and of one large female are tabulated below. Lengths given are straight distances, the body contour being eliminated.

Measurements in Centimeters of six adult Sea Elephants.

	1 ♂	2 ♂	3 ♂	4 ♂	5 ♂	6 ♀	Measurements of adult males nos. 1–5 averaged and reduced to per centum
Tip of snout to end of tail	370	362	419	408	455	265	100
Tip of snout to end of hind flippers	427	418	480	467	520	307	114.8
Tip of snout to anterior border of axilla	120	117	151	139	172	83	34.7
Tip of snout to inner canthus of eye	26.4		38	30.4	36.5	14	8.1
Tip of snout to corner of mouth	25.5		30		31.4	15	7.2
Tip of lower jaw to corner of mouth	14		18	15	22.5	11	4.3
Mouth, corner to corner	26		27.5	27	34	17.2	7.1
Length of eye opening			5.8	5.1	5.8	4.3	1.4
Breadth of head at external canthi of eyes			31.5	29.8	31.6	20.1	7.7
Pectoral flipper, anterior insertion to tip	57	63	65	55.5	69.5	44	15.4
Hind flipper from cruro-tarsal joint			81	75	76	55.5	19.2

In females the eye is relatively larger and both pairs of limbs average slightly longer in ratio to the body length. Other proportional differences are due chiefly to the absence of a long snout in the females.

When sea elephants are in best condition (from a sealer's point of view, at any rate) the girth nearly equals the extreme length. The fattest one that I saw was a bull 560 centimeters (18 feet 4 inches) long. It was so round and distended that it had the appearance of being pneumatic, and inflated under high pressure. Seven men could barely turn its body over with the aid of ropes and hand holes in its skin, even after half the blubber

had been removed and a trench had been scooped under one side of the carcass. Its blubber was 19 centimeters thick in the center of the breast and in the lumbar region.

Character of the Snout.

Concerning the character of the male sea elephant's snout or trunk, much wrong information exists in the literature. Dr. C. H. Townsend (1912) has disposed of the generally accepted tradition that the trunk is capable of inflation and that under excitement it is puffed up, like the hood of the bladder-nosed seal. A cursory dissection on the head of a large male which I brought from South Georgia shows that the upper and outer walls of the nostrils are composed of excessively developed dermal muscles the arrangement of which does not differ fundamentally from that of the nasal muscles in the harbor seal (*Phoca*). This heavy muscle layer is remarkably vascular, and is to all appearances true erectile tissue capable of being voluntarily charged with blood. Eliminating the inflation theory, such a great expansion of the snout as is shown in Fig. 19 can hardly be explained on any other hypothesis than that of erection by blood pressure. There are two or more blind vesicles leading upward from the nares at the middle of the lateral ethmoid cartilages, but they are far too small to permit appreciable inflation of the upper snout. Whether these culs-de-sac are homologous with the apparatus of the hooded seal (*Cystophora*) is a question which may be determined by further dissection and comparison of the material.

The snout of *Mirounga leonina* is entirely different from that of *M. angustirostris,* as may be seen by comparing the photographs of the latter species published by Rothschild (1908) and Townsend (1912) with the *leonina* pictures of Lönnberg (1906) and of the writer in the present paper. The whole nasal tube is narrower and shorter in the southern species, and is only slightly pendulous even in the case of the largest and oldest males. Nine out of ten of all those I saw at South Georgia had practically no "trunks" at all. The face in profile reminded me of that of a rat, except when the snout was drawn back and expanded into a series of tight ridges with the tip slightly overhanging the mouth. The most truly trunk-like snout that came under my notice was that of an animal only 480 centimeters long, the distance from the tip of the relaxed snout to the corner of the mouth in this instance being 30 centimeters (see table p. 74). During forcible expiration the rush of breath bulges out the nose and makes it vibrate. It then assumes its longest and straightest form as well as its greatest diameter (Fig. 8). The snout of the female sea elephant may be likened to that of a pug dog, the large, forwardly directed eyes adding to the resemblance.

Morphological Notes.

Bristles.— The vibrissæ of *Mirounga* are somewhat flattened, and have curious constrictions 2 millimeters or more apart extending from the base almost to the filamentous tip. The bristles have therefore a nodulated appearance like the antennæ of certain insects. They rarely exceed 1 millimeter in diameter at the base.

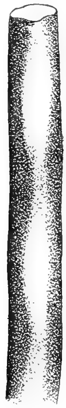

Fig. 3. Maxillary bristle of *Mirounga leonina.*

In old animals many of the bristles are often broken or lost. The perfect complement is as follows: —

7 brow bristles above the inner canthus of each eye. These bristles increase in diameter and length from before backwards and are arranged in the same order in rows of 1, 3, 2, 1, respectively.

1 nasal bristle at each end of the main transverse sulcus of the snout.

39 maxillary bristles on each side. These increase in size from before backwards, and are distributed in horizontal rows as follows: —

1st row (lowest)	6
2nd "	8
3rd "	8
4th "	7
5th "	6
6th " (top)	4

Eye.— The eye is exceedingly large. An eyeball taken from a fully grown male and preserved in alcohol is subspherical in form, measuring 74 millimeters transversely, and 67 millimeters in its antero-posterior diameter.

The cornea has a conspicuous network of bloodvessels which gives the eye a bloodshot appearance in life, particularly in the case of old males. The nictitating membrane is prominent and is passed over the eye frequently. The lachrymal glands are well developed and the tears so profuse that the region about the eye is usually wet, and continuous streamlets trickle from the sides of the face.

External Mammary and Reproductive Organs.— The teats become *inverted* after the end of the nursing season, and within each of the pockets thus formed I usually found a small pebble tightly wedged. Sealers, knowing the likelihood of such a condition, invariably avoid cutting into the teat pits with their skinning knives.

The urinogenital canal of the male emerges through a long, slender papilla appended at the tip of the *glans penis*.

Visceral Anatomy.— The following notes are based upon field dissections.

The tracheal and bronchial rings,[1] which among the Phocidæ exhibit their extremes of structure, are rather more than four-fifths complete.

From the body of a male sea elephant 418 centimeters long the small intestine was carefully floated, in order to avoid stretching, and it was found to be 81 meters in length. Its diameter was 2 centimeters. The length of the large intestine in the same animal was 145 centimeters. Subsequent measurements on several other specimens showed that the length of the small intestine averages about 20 times that of the body. The cæcum is obsolete.

The liver is large. Of the three main ventral divisions the central or cystic lobe is deeply subdivided, and smaller than the lateral lobes. The right lateral is broad and long; the left small and cordate. A Spigelian lobe and a long caudate lobe are present. The gall bladder is free, retort-shaped, with a large cystic duct.

A heavy, elongate pancreas, which seems to communicate with the alimentary tract by several ducts, balances on the left side the right lateral lobe of the liver.

The axillary glands are large, and there is a ductless gland within the muscle tissue on either side of the back over the position of the kidneys, lying just beneath the blubber layer.

The multilobulate kidneys are frequently unequal in size as well as asymmetrical in position, the right in some instances being almost twice as large as the left.

Arterial System.— The origin of the great blood vessels from the aortic arch is ontogenetically of the type common to most Carnivores, the left brachial alone having a separate source. In mature animals, however, the appearance is deceptive owing to the crowding together of all four arteries, which appear to arise from a single, short innominate trunk, as described by Turner (1887). The condition in young animals is shown in Fig. 4, drawn from the arch of a male pup. The relatively great contraction of the descending aorta is noteworthy.

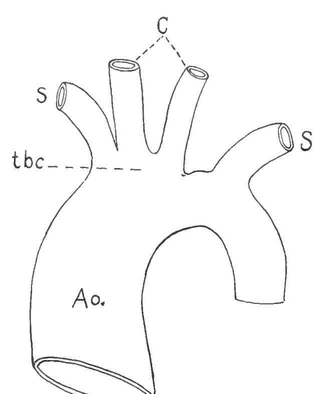

Fig. 4. Mode of origin of the great arteries from the aorta of *Mirounga leonina*, *tbc.*, brachiocephalic trunk; *s.*, subclavian; *c.*, carotid.

[1] Murphy, Bull. Amer. Mus. Nat. Hist., Vol. XXXII, p. 505.

The amount of blood in the body is astonishing. The following quotation from Anson's 'Voyage' (1748) is essentially true, even though the measure of a "hogshead" may here be indefinite: "....if they are deeply wounded in a dozen places, there will instantly gush out as many fountains of blood, spouting to a considerable distance; and to try what quantity of blood they contained, we shot one first, and then cut its throat, and measuring the blood that came from him, we found, that besides what remained in the vessels,....we got at least two hogsheads."

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EXPLANATION OF PLATES.

Plate I.

Fig. 5. "Pup" sea elephant, Nov. 25, 1912, Cumberland Bay.

Fig. 6. Yearling ♂ asleep, showing navel, penis sheath, and vent, Nov. 30, 1912, Cumberland Bay.

Fig. 7. Head of adult ♀, Nov. 25, 1912, Cumberland Bay.

Fig. 8. Adult ♂, showing relaxed snout, and shedding hair, Dec. 22, 1912, Bay of Isles.

Fig. 9. Head of large ♂ (No. 5 of table p. 74). Feb. 17, 1913, Bay of Isles.

Fig. 10. Adult ♂, Jan. 9, 1913, Bay of Isles.

Plate II.

Figs. 11–13. Three views of the same adult ♂, shown in Fig. 10.

Figs. 14, 15. Two views of the same nearly full grown ♂, Dec. 13, 1912, Bay of Isles.

Fig. 16. Fore flipper of an adult ♂, Jan. 9, 1913, Bay of Isles.

Plate III.

Fig. 17. Hind flippers of an adult ♂, Jan. 9, 1913, Bay of Isles.

Fig. 18. Adult ♂ swimming, Jan. 10, 1913, Bay of Isles.

Plate IV.

Fig. 19. Very large ♂, Cumberland Bay. Photo by J. Innes Wilson. This shows the maximum expansion of the snout.

Fig. 20. Nearly full grown ♂ making for the water, and glancing backward as it runs, Dec. 23, 1912, Bay of Isles.

Plate V.

Fig. 21. Adult ♀, Dec. 3, 1912, Cumberland Bay.

Fig. 22. Adult ♂ asleep, throwing sand on its back, Jan. 9, 1913, Bay of Isles.

Fig. 23. Adult ♂ rearing, Feb. 20, 1913, Bay of Isles.

Plate VI.

Fig. 24. Enraged adult ♂, the same animal shown in Fig. 23. Feb. 20, 1913, Bay of Isles. Compare with Lord Anson's drawing, p. 68.

Fig. 25. Nearly full grown ♂ rearing to attack; the same animal shown in Figs. 14, 15, and 20. Dec. 23, 1913, Bay of Isles.

Plate VII.

Fig. 26. Males fighting, Cumberland Bay. Photo by J. Innes Wilson.

Fig. 27. The "Beachmaster"; adult ♂ with herd of cows. Cumberland Bay. Photo by J. Innes Wilson.

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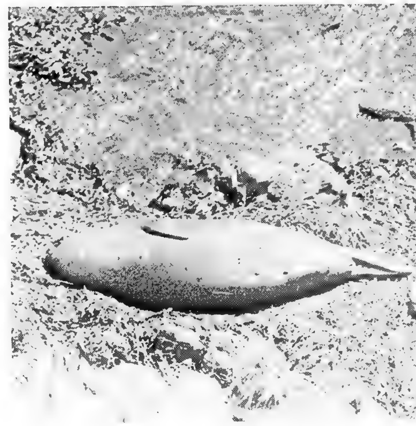

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Mirounga leonina.

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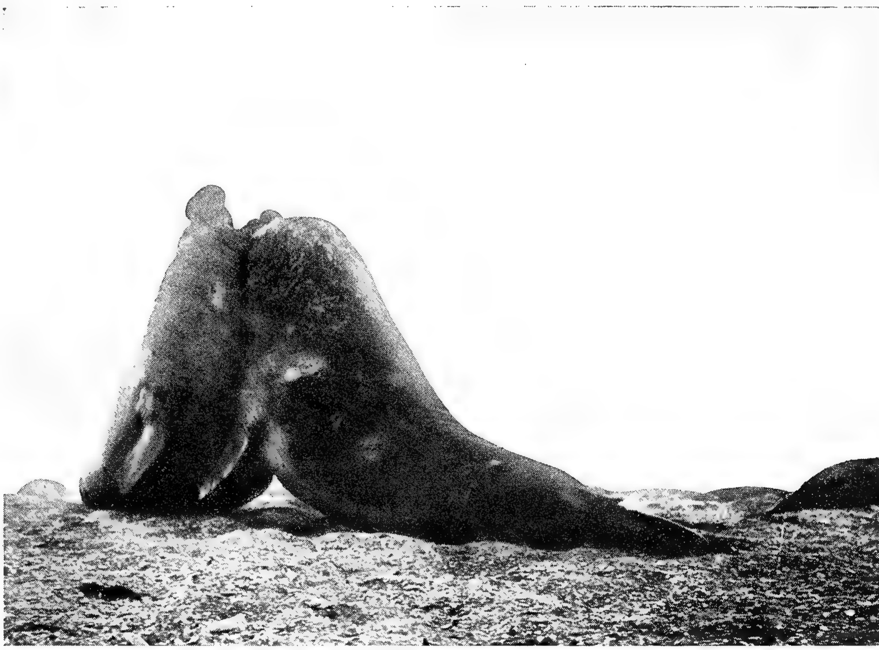
MIROUNGA LEONINA.



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Mirounga leonina.

59.7,54S (75.9)

Article III.— ON A NEW SWELL-FISH FROM FLORIDA.

By John Treadwell Nichols.

The collections of the American Museum of Natural History contain an undescribed species of *Spheroides,* which was thought to be *S. maculatus* when it was collected at Cape Sable, Florida, in 1910, but is, in reality, quite different.

Spheroides harperi sp. nov.

The type, No. 2535, American Museum of Natural History, taken at Cape Sable, Florida, by the Fabbri Tekla Expedition, February, 1910, is 175 mm. long to the base of the caudal; depth 4.0 in this measure; head 2.8; eye 4.0 in head; snout 1.9; interorbital slightly concave, the bone at its narrowest about one half the greatest diameter of the eye. A rather slender fish with narrow, pointed head and large eye. Dorsal rather high, its free margin truncate, its longest ray 2.6 in the head. Anal much lower, rounded, its longest ray 3.3. Pectoral broad, its length 2.0. Caudal square or slightly rounded, 1.8. Dorsal 8. Anal 7. Nasal tubes large, their length 3.0 in eye. No spines anywhere, the back and sides covered with minute, obsolete, imbricate scales, the lower parts peculiarly and minutely grooved and wrinkled. A well marked fold along the under side of the head. The color of the alcoholic specimen is not well preserved, but shows small, pale, roundish specks everywhere on back and sides, and a row of dark blotches along the division between dark upper and whitish under parts. These suggest the marks of *maculatus* more than those of *spengleri.* There is a more pronounced elongate one in the axil, along the lower base of the pectoral.

Besides the type, we have three much smaller specimens collected at the same place and date, No. 2589, two 35 and one 53 mm. long. These have an area of varying size on the anterior part of the back, thickly beset with minute prickles, many small, roundish black spots more pronounced than the small white ones, which are also present on the upper parts, a row of diffuse dark blotches along the sides more suggestive of *maculatus* than of *spengleri,* a most pronounced one at the posterior base of the pectoral. One of the two smaller specimens is the most prickly, and differs from the others in having the under parts also thickly beset with prickles; the other of 35 mm. length is the smoothest of the three.

The species is named for Mr. Francis Harper, a fellow-member of the Linnæan Society of New York, who first called the writer's attention to the differences between the type and *S. maculatus.*

It is closest to *S. spengleri* and *S. nephelus.* The former differs notably from it in color, the latter in spination. Though both are from Florida, the

ranges of *nephelus* and *harperi* may be separated by *S. testudineus,* a species widely distributed southward, and abundant at Miami. A review of the most striking characters of 6 species of *Spheroides* from Atlantic North America, now on the writer's table, will not be out of place here.

Spheroides maculatus (Bloch & Schneider), represented by specimens from Woods Hole, Mass., Long Island, N. Y., and Cape Lookout, N. C., has the interorbital of medium width, the narrowest breadth of the bone a little shorter than the eye; is thickly beset with small prickles above and below; and has a row of mostly vertically elongate dark blotches on the side. These are fainter on the head, and there is usually a very pronounced one touching or hugging the axil of the pectoral. The largest specimen examined is 195 mm. long to base of caudal.

Spheroides spengleri (Bloch), represented by specimens from Katama Bay, Mass., Cape Lookout, N. C. and Key West, Fla., has a narrower, more pointed head, the interorbital bone about one-half the eye. It has rather large, embedded prickles below and is usually smooth above. A regular row of strong, roundish dark blotches along the side, well marked on the head, forms a diagnostic color character. The caudal has a whitish center and blackish base and end. The upper parts sometimes bear membranous flaps, and two small specimens from Porto Rico are prickly above. The largest specimen examined is 100 mm. long to base of caudal.

Spheroides nephelus (Goode & Bean). Through the courtesy of the United States National Museum and of Mr. Barton A. Bean, of that institution, I am enabled to compare one of the cotypes of this species, No. 31428, from Indian River, Florida. It has peculiar, strong, rather wide-set, stellate based prickles above, and well developed, rather close-set prickles below. The lateral row of blotches is indistinct, and suggests *maculatus* and *harperi,* being quite unlike *spengleri.* The interorbital bone is about one-half the eye. The specimen is 150 mm. long. Mr. Bean has kindly examined the other specimens mentioned in the type description of *nephelus,* and writes that the narrowest interorbital measurement is contained two to two and one-half times in the longest diameter of the eye.

Spheroides testudineus (Linnæus), represented by specimens from Miami, Fla., Livingston, Guatemala, and Brazil, has the back dark, the color broken up by a coarse, regular network of white lines, with concentric tendencies. Sides with small, scattered, round dark spots and no preëminent series of dark blotches bounding the white under parts. Interorbital broad, the least breadth of the bone equal to, or greater than, the eye. In small specimens of 40 to 50 mm., the interorbital is much narrower, the spots on the sides are fewer and comparatively larger, the lower ones more regularly placed. At any age it is the species most strikingly distinct of those men-

tioned in this paper. The largest specimen examined is 185 mm. long to base of caudal.

The most striking characters of *Spheroides harperi* are the pointed head, narrow interorbital, and absence of prickles in the grown specimen.

Spheroides marmoratus (Ranzani). Of this species we have a single specimen 140 mm. long, from the Gulf of Mexico, collected by Capt. Frank Seeley of the Ward Line. It has a raised orbital region, very narrow, decidedly concave interorbital, the breadth of the bone less than one-half the long diameter of the eye; long, slightly concave snout; very small nasal tubes, their height less than one-fifth the diameter of the eye, an irregular network of fine pale lines separating darker spots on the sides, the diameter of mesh about equal to the pupil. Lateral blotches smaller and less distinct, but not dissimilar to those of *maculatus*. A patch of strong prickles on the back behind the eyes, crowded anteriorly, becoming more scattered posteriorly, about reaching dorsal. Under parts smooth, the spines (if present) obsolete and deeply imbedded. A sharp fold or keel along the lower angles of the body from opposite nasal tubes to opposite dorsal.

59.7 (82.9)

Article IV.— NOTES ON A SMALL COLLECTION OF FISHES FROM PATAGONIA AND TIERRA DEL FUEGO.

By L. Hussakof.

The fishes of the extreme southern part of South America are already well known in outline, thanks to the many antarctic and other expeditions to that region; but much still remains to be learned regarding the distribution, variation and ecology of most of the forms, some of which are represented by only a few specimens scattered in different museums. For this reason any data bearing on this fauna are valuable, and should be put on record. It was with this idea in mind that the following notes were brought together. They are based on a series of 74 specimens, representing 14 species, collected by Mr. Barnum Brown of the American Museum of Natural History, in Patagonia and Tierra del Fuego, in 1899–1900. As Mr. Brown's special mission was to collect fossil mammals, fishes and other natural history specimens were gathered only incidentally, as opportunity offered, so that the collection is necessarily small; still it contains a number of features of considerable interest.

The specimens are all either from the Atlantic side of Patagonia, south of the Santa Cruz River (Latitude 50° S.), or from Tierra del Fuego. With the exception of the genus *Galaxias*, all are marine.

1. **Myxine australis** *Jenyns.*

Two specimens, 230 and 298 mm. respectively; north of the mouth of the Rio Coyle, Patagonia.

In the larger specimen the distance to the gill opening is contained 3.38 times in the length; in the smaller, 3.48 times. The number of pores in the larger specimen is, 33+54+8–10 (8 on the left side, 10 on the right).

It may here be mentioned, since the fact is sometimes overlooked by authors, that a second species of *Myxine* is known from this region — *M. tridentiger* Garman,[1] recorded from the extreme southern part of South America.

2. **Squalus fernandinus** *Molina.*

A single specimen, 225 mm. in length; 25 miles south of the mouth of the Rio Coyle, Patagonia.

[1] Mem. Mus. Compar. Zool. Harvard College, XXIV, 1899, p. 345.

3. **Egg-case of an Elasmobranch** (Fig. 1).

A remarkable shark egg-case is represented in the collection (No. 5000, Am. Mus.), which I am unable definitely to identify. A similar specimen, from the same locality, was figured by Vaillant in 1891 (Mission Sci. du Cap Horn, t. VI, Poissons, pl. i, fig. 1 F.), who considered it to belong to *Scyllium.* But it is obvious, on comparison with a *Scyllium* egg capsule, that it is not of that genus. In the *Scyllium* capsule the upper margin is truncated and filaments emanate from the angles, whereas in the present specimen the upper margin is rounded and without filaments. There are preserved the remains of the delicate fibrous tissue by which the capsule was attached to the ovarian tube of the shark; this tissue is rolled together into a band on each side and the two bands are intertwined. (Fig. 1). Only four sharks have been recorded from this region — two species of *Acanthias,* a *Centroscyllium,* and a *Scyllium;* and the present capsule does not seem to belong to any of these. It is not *Scyllium,* for the reasons given above; it cannot be *Acanthias,* since this genus is viviparous; and it is in all probability not *Centroscyllium,* since this shark belongs in the same family with *Acanthias* and is very probably also viviparous. It would thus seem that the present egg-case represents a shark not yet recorded from this locality.

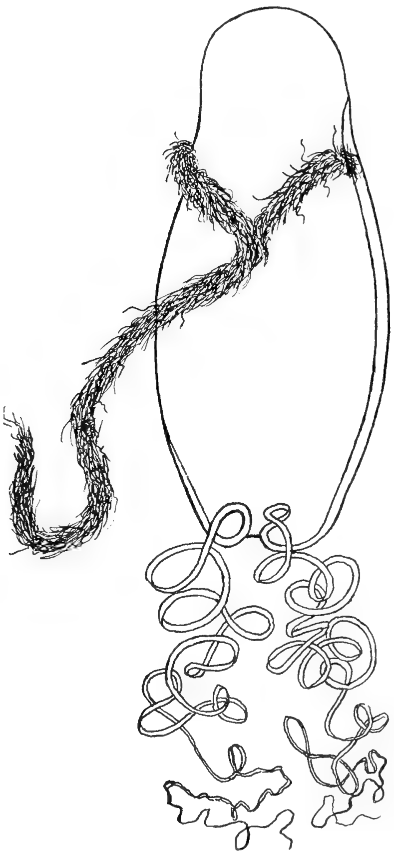

Fig. 1. Egg-case of a shark of unknown species; natural size. Southern Patagonia.

It may be mentioned, in passing, that the egg-case from the Straits of Magellan, figured by Günther in his 'Introduction to the Study of Fishes' (p. 167), and considered by him as probably belonging to *Scyllium chilense,* is correctly referred to that genus, and is quite distinct from the present specimen.

4. **Egg-case of Raja** sp. (Fig. 2).

Four egg-cases; 30 miles south of the Santa Cruz River, Patagonia. No. 5001, Am. Mus.

These egg-cases are remarkable for their extraordinarily long filaments, which are many times longer than in any *Raja* egg-case yet known. In

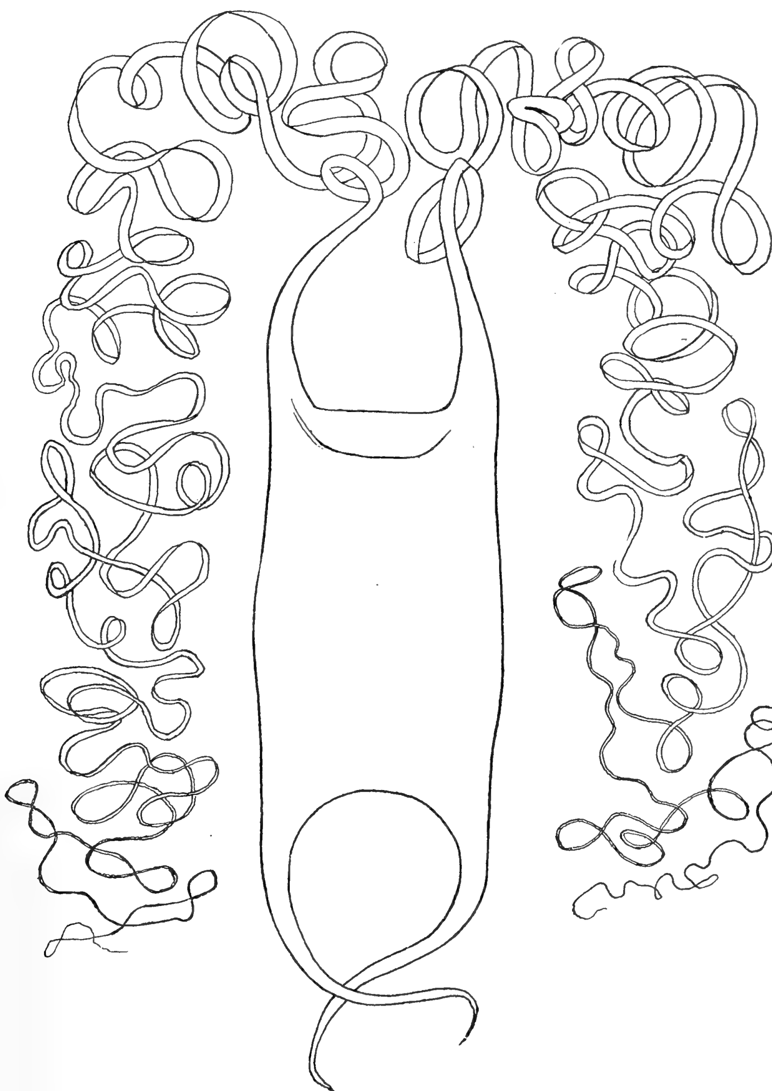

Fig. 2. Egg-case of *Raja* sp., $\times \frac{5}{6}$. Southern Patagonia.

Raja circularis, hitherto regarded as the extreme in respect to the length of the upper filaments, these are only 2.5 times as long as the body of the egg-case; but in the present species they are as much as 15 times the length of the body of the case. The filaments are, of course, knotted into a dense mass, so that it is almost impossible to unravel one completely and measure it. One was carefully traced for a length of 809 mm., and this was still considerably short of the entire filament. Since the body of the capsule is 54–60 mm. in length, the filaments are thus 14 or 15 times as long. The lower filaments are about as in other species of *Raja.*

5. **Clupea fuegensis** *Jenyns.*

Four specimens, 124 to 167 mm. in total length; Ushuaia, Tierra del Fuego.

According to a note by Mr. Brown, the Indians go out in boats to the kelp and catch these little fishes in their hands, while they are feeding.

The four specimens agree with *Clupea fuegensis* as far as the meager description by Jenyns (Zool. of the 'Beagle,' vol. III, Fishes, p. 133), who had only a single specimen, allows of comparison. The number of rays in the dorsal and anal agrees with his description, and the origin of the ventrals is underneath the origin of the dorsal. *Clupea arcuata* Jenyns, seems to be merely a synonym of *C. fuegensis,* the only difference between the two pointed out by Jenyns, being the somewhat larger anal in the former, with 23 instead of 19 rays. Vaillant has given an excellent figure (Mission Sci. du Cap Horn, t. VI, Poissons, p. C. 16, pl. ii. fig. 2) of this species, under the name of *C. arcuata,* with which the American Museum specimens agree.

The following diagnosis may be found useful:

Head slightly over 4 in length to base of caudal; depth somewhat less than head, and $4\frac{2}{5}$ in length. Eye, equal to snout, and $3\frac{1}{2}$ in head. Dorsal 18; anal 19 or 20. Origin of ventrals under, or slightly in advance of, origin of dorsal, and equidistant from tip of pectoral and origin of anal. Ventrals extending two-fifths the distance from their origin to the beginning of anal. Origin of anal a short distance behind tip of dorsal when laid back. Depth of peduncle, a little less than 3 in depth of fish. Scales, about 50 in longitudinal series; 13 in transverse.

6. **Notothenia coriiceps** *Richardson.*

Seventeen specimens, 50 to 130 mm. in total length; 12 from 25 miles south of the Rio Coyle, Patagonia; 5 from Ushuaia, Tierra del Fuego.

This is the most widely distributed species of the Nototheniidæ, being

circumpolar in distribution. It has been recorded from both coasts of southern Patagonia, from the Strait of Magellan, South Georgia Island, Kerguelen, Chatham Island, New Zealand, Auckland Island, Victoria Land, and the antarctic seas generally. As one would expect with so widely ranging a form, the species is highly variable, and shows a number of local phases some of which have received distinct names.[1]

The largest specimen (130 mm.) in the series is of special interest, since it throws light on the breeding season of the species. It was collected May 25, 1899, and is greatly distended with eggs. These are over .5 mm. in diameter, but from their long immersion in formalin and alcohol, cannot be studied in detail. No. 5003, Amer. Mus.

Color.— The young (in alcohol) are light brown above, traversed by six more or less regular, dark brown bands, the first on the nape, the last at the base of the caudal; under side pale. The hinder portion of the spinous dorsal is blackish; the soft dorsal grayish, with narrow darkish bands running obliquely upward and backward. The caudal has four or five darkish bands similar to those on the soft dorsal, and the anal a few dark spots. In the adult, the head and back are darker than in the young, and the bands are more or less obsolete; the fins, however, retain a good deal of their darkish mottling.

The variation in the number of fin rays, and in one or two other details, was found to be as follows:

Dorsal V–VI, 29–34; anal 27–33, 28 or 29 predominating. Interorbital width $4\frac{1}{2}$ to 6 in length of head, $5\frac{1}{2}$ to $5\frac{4}{5}$ predominating. Head $3\frac{1}{2}$ in length to base of caudal. Width of head $1\frac{1}{2}$ in its length.

7. **Notothenia macrocephala** *Günther.*

Two specimens, 128 and 152 mm. to base of caudal; one from Ushuaia, Tierra del Fuego, the other without record, but probably from the same locality.

Dorsal IV–V, 30–31; anal 24–25. Interorbital width about $2\frac{1}{2}$ in length of head; scales in lateral line, about 62.

8. **Notothenia tessellata** *Richardson.*

A single specimen, 140 mm. in total length; Ushuaia, Tierra del Fuego.

This specimen agrees in general appearance with those of *N. canina* mentioned below, except that the teeth are not so large and there are more

[1] See synonymy by Boulenger in, "Report on the collections of natural history made in the antarctic regions during the voyage of the 'Southern Cross.'" London, 1902. 8°. p. 183.

scales in the longitudinal series — about 85 as against 71–79. Head $3\frac{1}{2}$ in length to base of caudal. Interorbital width 5 in head. Dorsal VI, 34; anal 32.

9. **Notothenia canina** *Smitt.*

Two specimens, 71 and 171 mm. in total length; 25 miles south of the Rio Coyle, Patagonia, and Ushuaia, Tierra del Fuego.

The larger specimen has very conspicuous canine teeth; the principal character, as pointed out by Boulenger [1] distinguishing this species from *N. tessellata.* In this specimen the head is contained $3\frac{1}{2}$ times in the length to base of caudal, and the depth a little over 5. Interorbital width 5 in length of head. Lower jaw projecting considerably beyond the upper. Dorsal VI, 34; anal 31. Ventrals three-fifths length of head, and five-sixths length of pectoral. Scales in longitudinal series, 79 in the larger specimen, 71 in the smaller.

Both specimens are much faded in color (in alcohol), but the fish apparently had dark bands on the body. The hinder half of the spinous dorsal is blackish, and the end of the caudal was apparently also this color.

10. **Harpagifer bispinus** (*Forster*).

Twenty specimens, 47 to 74 mm. in total length; 17 from Ushuaia, Tierra del Fuego, 3 from north of the Rio Coyle, Patagonia. The latter were collected under rocks at low tide and are of a much paler color, although with the same bands and mottlings on the body and fins as the others. They also have one ray more in the spinous dorsal — that is, 4 instead of the usual 3 — but otherwise are quite similar to those from Ushuaia.

This interesting little fish is common throughout this region. It is a shore-fish, occurring in tide pools, under rocks and in the kelp in shallow water. It was once taken at a depth of 50 to 75 fathoms — by the 'Challenger' — but it had probably been carried out with kelp, and does not ordinarily live at such a depth.

One of the largest specimens (61 mm. to base of caudal) is greatly distended with eggs (collected March 30, 1900, Tierra del Fuego). These are remarkably large for a species of such small size, measuring about 1.5 mm. in diameter. No. 5011, Am. Mus.

The fin formula of the species is somewhat variable: dorsal III–IV, 22–25; anal 17–20. Head contained $2\frac{3}{4}$ to 3 times in length to base of caudal.

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[1] *Loc. cit.*, p. 183.

11. **Lycodes latitans** (*Jenyns*).

Five specimens, 115 to 283 mm. in length; near mouth of the Rio Coyle, Patagonia. Collected from under rocks at low tide. One of the smaller specimens had its mouth filled with fragments of kelp on which it had been feeding.

As has been pointed out by previous writers,[1] there is great variation in the Lycodidæ, which makes the separation of species difficult. In the present species variation is shown among the specimens in hand, as well as on comparison of these with the descriptions given by authors. For instance, the largest specimen (283 mm.) has a smaller eye and a somewhat longer head than the specimen described by Günther in his catalogue of the fishes in the British Museum (Vol. IV, p. 321). The species reaches a length of at least 360 mm., as shown by a specimen of this size recorded by Vaillant (Mission Sci. du Cap Horn, t. VI, p. C. 21).

Color.— The young of this species are more or less barred with whitish (in alcohol); the smallest specimen in hand has a pale band on the occiput, and another on the back and the dorsal fin at a point opposite the end of the pectoral; also obscure indications of one or two other bands on the hinder half of the fish. The white horizontal bar under the eye, and the pale spot on the lower half of the opercle, are also rather more distinct than in the adult. In the next larger specimen, 126 mm., the bar under the eye is reduced to a small spot, and all the bands have disappeared, so that the fish has the uniform coloration of the adult: dark brown above, paling slightly downward on the sides, and the lower jaw, lower half of the operculum and the gular region whitish.

In the 283 mm. specimen the head is contained 5 times and the depth $9\frac{2}{3}$, in the total length. Pectoral $1\frac{2}{3}$ in distance from its tip to origin of the anal fin. Distance from tip of snout to origin of anal somewhat less than one-half the entire length of the fish.

12. **Platea insignis** *Steindachner.*

Zool. Jahrb. Suppl.-Bd. IV, 1898, p. 323, pl. xx, figs. 12–12b.

A single specimen, 358 mm. in length; taken near a wreck, Policarpo Bay, Tierra del Fuego. No. 5015, Am. Mus.

This is the second specimen of this genus to be put on record. It differs from Steindachner's specimen (according to his description), in being some-

[1] For instance, F. A. Smitt "On the genus *Lycodes*." Ann. Mag. Nat. Hist., 7 ser., V, 1900, pp. 56–58.

what deeper (depth about $11\frac{1}{2}$ instead of $14\frac{1}{2}$ in the length); in having a smaller eye, the interorbital space being a little wider than in his specimen, and in one or two other details. But the general correspondence, including that of the details of color, is extremely close. There is only a little more mottling on the front part of the anal fin in this specimen than in the type.

Measurements of a Specimen of Platea insignis.

	mm.	*Remarks*
Total length	358	
Tip of snout to origin of anal	114	.32 of the length
Origin of anal to posterior extremity of fish	244	.68 " " "
Head	52	Contained 6.9 in the length
Depth	31	" 11.6 " " "
Eye	6	" 8.66 " " head
Interorbital space	12	" 4.33 " " "
Snout	17	" 3. " " "
Greatest breadth of head	41	
Pectoral (measured from its lower attachment	37	" 1.4 " " "
Ventral	10	" 5.2 " " "

13. **Maynea patagonica** *Cunningham.*

A single specimen, 142 mm. in length. South of Latitude 50° S; exact locality not recorded.

This is a rare species, only seven or eight specimens having been previously recorded. As pointed out by Günther (Proc. Zool. Soc. London, 1881, p. 20), *Maynea* resembles *Gymnelis* in the young being banded whilst the adults are of a dull, uniform color. Our specimen agrees in coloration with the one figured by Günther, which it exceeds by about 2 inches. It has a brown ground color (in alcohol), somewhat darker on top of the head, and is traversed by 13 pale bands which cross the body and the dorsal and anal fins; first band on occiput, second crossing dorsal fin; the fifth crossing both the dorsal and anal. The pale areas are less than half the width of the intervening colored bands. The jaws and the region underneath the eye, to within a short distance of the gill opening, pale with slight mottling; gular region and ventral side of the body, to within a short distance back of the pectorals, also pale; pectoral fins darkish except along the margins, which are pale; tip of tail whitish.[1]

[1] The specimen is covered with an opaque precipitate of slime, but none the less the coloration can be clearly made out.

It may be mentioned that in lacking ventral fins, *Maynea* is more closely allied to *Gymnelis* than to *Lycodes*.

Head $7\frac{1}{3}$ in total length; depth $12\frac{1}{2}$. Eye equal to interorbital width and about $1\frac{2}{3}$ times in snout. Upper jaw slightly projecting beyond lower. Origin of dorsal above posterior extremity of opercular membrane; origin of anal under beginning of second fourth of the dorsal.

14. **Galaxias maculatus** (*Jenyns*).

Thirteen specimens, 45 to 81 mm. in total length. From fresh water, Thetis Bay, Tierra del Fuego, March 6–7, 1900.

A careful study of these 13 fishes raises the question whether *G. maculatus* and *G. attenuatus* are really distinct species. According to Regan's revision of the Galaxiidæ (Proc. Zool. Soc. London, 1905, pp. 363–384, pls. x–xiii), a trenchant difference between these two species consists in the position of the ventral fins: in *maculatus* their origin is nearer the base of the caudal than the tip of the snout; in *attenuatus* it is either nearer the tip of the snout than the base of the caudal, or else equidistant from these two points. Now in the present lot of 13 specimens, which seem by coloration and general proportions undoubtedly of one species, one finds all three positions of the ventral fins, and among those which have the *maculatus* fin position clearest expressed, one finds a strong agreement in other characters with *G. attenuatus,* and *vice versa;* so that one is uncertain, in the case of several of the specimens, whether to refer them to the one or the other species. For instance, the largest specimen in the lot, 81 mm. in total length, agrees closely with the diagnosis of *G. maculatus;* and yet the snout — to mention only one character of several that might be given — is not less than the eye, as it should be in this species, but $1\frac{1}{3}$ times the eye, as in *G. attenuatus*. The conclusion from a series of such comparisons, involving various characters, is, that the forms distinguished as *G. maculatus* and *G. attenuatus* are really varieties of one species.

It may be urged that this view is based on specimens that are immature, the largest being only 81 mm. in total length, which is considerably less than the adult of this species; that while the young of *G. maculatus* and *G. attenuatus* may overlap in certain characters, the adults are really distinct and constitute two good species. This is of course an important objection, and must be given full weight in a re-study of the two forms. But unless it can be shown that full-grown specimens of *G. maculatus* and *G. attenuatus* are more definitely separated from each other than the younger specimens in hand are, the two forms will have to be merged under one name, *Galaxias maculatus*.

Color (in alcohol).— Head and median line of back darkish; sides with a pale orange ground color over which are diffused innumerable purplish dots arranged in patterns, making the fish appear at a little distance as if purplish, with pale marbling. In the younger specimen (60 mm. in total length) the back is not quite so dark, and the dots on the sides are distributed evenly, so that the specimen appears at a little distance of a uniform purplish color, which gradually pales downward.

Bibliographical Note.

A detailed analytical bibliography of the fishes known from the Strait of Magellan and neighboring waters was given by Louis Dollo on pages 67–78 of the "Résultats du voyage du S. Y. 'Belgica.'" Expedition antarctic Belge. Anvers, 1904. Poissons. 1–239 p., i–xii pls. 4°.

To this need only be added the following important references:

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Article V.— ON TWO AMBICOLORATE SPECIMENS OF THE SUMMER FLOUNDER, *PARALICHTHYS DENTATUS*, WITH AN EXPLANATION OF AMBICOLORATION.

By L. Hussakof.

Among various species of flatfishes having a white under side, there is occasionally found a specimen with this side partly or completely colored like the upper. Such specimens are known as *ambicolorate* — a term introduced by J. T. Cunningham in 1893 [5]. They have attracted considerable attention because of their bearing on the theories of coloration in fishes, and quite a literature has grown up about them, particularly in Europe. In America ambicolorate flatfishes have been but little studied; I have found only a single reference to such a specimen. This was an example of the southern flounder, *Paralichthys lethostigmus,* having both upper and under sides "equally dark colored," which was briefly described by Storer in 1861 [8]. Recently two ambicolorate specimens of the summer flounder, *Paralichthys dentatus,* have come into my hands in a collection of fishes from the coast of North Carolina, presented to the American Museum by Mr. Russell J. Coles, of Danville, Va.; and the following notes are based upon them.

The two specimens (Nos. 5067 and 3735, Am. Mus.), are respectively 283 and 451 mm. in total length, including caudal. They were taken in seines with other fishes, off Cape Lookout, North Carolina, one in July, the other in September, 1912. They present none of the morphological abnormalities sometimes found in ambicolorate flatfishes; the migration of the eye from the blind side is complete, the anterior termination of the dorsal fin is not formed into a fleshy protuberance arched forward over the eye, and there are no spines or tubercles on the under side. The coloration of the eyed side is normal, except that the dark spots characteristic of the species are rather faded, especially in the larger specimen. But as this condition is frequently found in normal specimens, it has no bearing on the ambicoloration.

The pigmentation of the under sides of the two specimens is well represented in Figures 1 and 2, and no detailed description of it is necessary. It need only be mentioned that the dark areas are not abruptly demarcated from the pale ones, but blend gently into them along a broken line.

I have carefully compared the two specimens with a normally colored one for any differences in proportions and other regards, but have found none. As shown in the following table, the head and the depth bear about

the same proportions to the length, allowing for variation due to difference in size, as in the normal specimen; and the pectoral of the blind side in both instances is about one-fifth shorter than that of the eyed side.

Comparison of Ambicolorate and Normal Specimens of Paralichthys dentatus.

	Ambicolorate		Normal
	(Fig. 1)	(Fig. 2)	
Total length (to end of caudal)	451 mm.	283 mm.	394 mm.
Pectoral of eyed side	48 "	35 "	40 "
" " blind "	38 "	27 "	32.5 "
Ventral of eyed side	27 "	22 "	25 "
" " blind "	27 "	21 "	25 "
Head in total length	4.2 times	3.9 times	4.6 times
Depth in " "	2.8 "	2.9 "	2.8 "
Pectoral of blind side contained in pectoral of eyed side	1.26 "	1.29 "	1.23 "

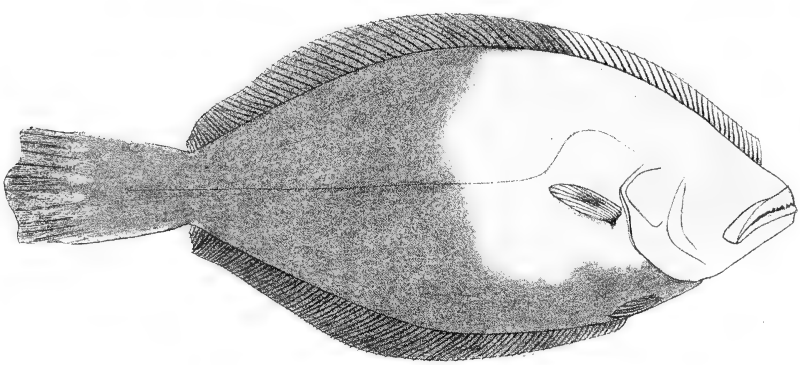

Fig. 1. Under side of an ambicolorate specimen of *Paralichthys dentatus*, 451 mm. in total length.

Theoretical Considerations.

Ambicoloration has already been recorded in four genera, and, if we include the present specimens, in nine species of flatfishes, namely:

1.	*Pleuronectes flesus*	6.	*Rhombus lævis*
2.	" *italicus*	7.	" *maximus*
3.	" *limanda*	8.	*Paralichthys lethostigmus*
4.	" *platessa*	9.	" *dentatus*
5.	*Solea vulgaris*		

It is thus seen to be a widely distributed abnormality, and will probably be found in still other species, in fact in most, if not all, flatfishes with a normally pale under side, and which live in relatively shallow water.

What is the cause of ambicoloration in flatfishes?

Some of the earlier writers on fishes (Daubenton, Bonnaterre, Lacépède) regarded ambicoloration as a specific character. Later, it was recognized that it could not be a specific character since it occurred in different flatfishes which, except for this abnormality, agreed entirely with well-recognized species. The phenomenon, however, was not easy to explain. Five or six different theories have been put forward to account for it. Among these are: reversion to the ancestral, bilaterally symmetrical condition; *homœosis*, or a mutation in the direction of secondary bilateral symmetry; direct illumination of the under side of the adult fish; the swimming of the embryo in the normal fish position for a longer period than usual, and its consequent longer exposure to light while in this position; germinal factors; some interference with the mechanism of embryonic transformation. Most of these views have been discussed by Bateson [1; 1894], and more recently by Gemmill [7; 1912], so that it is unnecessary to review them again.

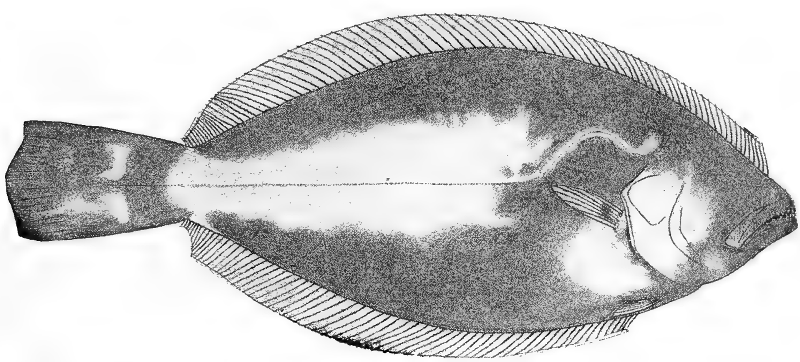

Fig. 2. Under side of an ambicolorate specimen of *Paralichthys dentatus*, 283 mm. in total length.

To the writer it seems needless to search for an obscure cause of the abnormality; we have a satisfactory explanation of it in the two series of experiments by Cunningham [4], as was indeed indicated by this writer himself. These observations are, first, that on the action of light on the under side of flatfishes [3]; secondly, that on flatfishes that had been living for a considerable time on a slaty bottom [4]. Neither of these observations by itself will suffice to explain the abnormality, but the two together afford as satisfactory an explanation of it as seems possible.

From Cunningham's classic experiments on the action of light on flat-

fishes [3, 5] it is known that the white under side of these fishes when exposed to light, becomes more or less pigmented like the upper, the intensity and extent of the pigmentation depending, (1) on the age of the fish, the action being the more intense the younger the specimen, and, (2) on the duration of the exposure. At a first glance these experiments might seem to offer a key for the solution of the problem of ambicoloration. It might be thought that the swimming of ambicolorate flatfishes is abnormal; they bend or twist in some such way that part of the pale under side is exposed to light, and so gradually becomes pigmented. It was an explanation similar to this, in fact, that was offered by Giard [6].

But are the movements of ambicolorate flatfishes in any way abnormal? In two instances on record specimens have been kept in aquaria under observation for months,— by Cunningham in 1894 (plaice), and by Cuénot in 1905 (sole) — and absolutely nothing abnormal was noticed in their movements. There is thus evidence that the coloration of the under side is not due to its direct exposure to light.

Moreover, on the view of direct exposure, how can we account for the peculiar distribution of the pigmented areas? Why, for instance, should there be in the specimen shown in Figure 2, a pale band along the arched portion of the lateral line if, as we must believe from the darkened area around it, this entire region of the fish had been exposed to light? There is frequently in ambicolorate specimens a narrow, dark band on the middle portion of the lateral line, while either side of it is pale. How can we account for this dark band if this entire region of the fish, judged by the pale area around it, had not been exposed to light? It is thus seen that there are strong reasons against the view that ambicoloration is caused by direct exposure to light, due to abnormal movements of the fish.

But the phenomenon finds a ready explanation in the light of a second observation made by Cunningham [4]. He found, quite unexpectedly, in the case of five flatfishes — two flounders, two plaice, and a sole — which had lived in a tank with a slate bottom for a year and a half, that the two flounders and the two plaice showed a striking ambicoloration, and the sole too was colored on the under side to some extent. The only light that had reached these specimens was from the front of the tank, the bottom and sides being of slate; and they had behaved normally, neither twisting nor turning so that light might strike them from above. On taking one of these specimens out of the tank and placing it on a slab of slate, Cunningham found that the fish did not leave a solid imprint of its under side, but that there were areas at which it was not in contact with the slate and so left no imprint. And the imprint of the entire fish, curiously, was an exact negative of an ambicolorate specimen. Cunningham then concluded that

the effect must be due to the light entering horizontally or obliquely, and reaching areas which were not in contact with the bottom and in course of time pigmenting them. To test this view, he placed a flounder on a sheet of photographic paper in a dark room, the specimen resting just as it had done on the slate bottom, and exposed it for a few seconds to light striking the fish more or less horizontally. The photograph thus made was an exact picture of an ambicolorate specimen, even to the narrow band of color along the lateral line of the fish, the light apparently being reflected and reaching this area. This experiment afforded a striking confirmation of this view.

In the light of this experiment we may conclude that in nature ambicoloration is produced whenever a fish lives on a hard instead of a sandy bottom, so that it cannot bury itself completely with the under side. Light falling through the shallow water strikes the flounder horizontally or obliquely, and penetrates to the areas not in contact with the bottom and gradually colors them. If at successive periods different parts of the under side of the fish come to be in contact with the bottom, these different areas become pigmented, and in the course of time the entire under side may resemble the upper, producing a perfect so-called "double" flatfish.

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56.4(118:78)

Article VI.—TERTIARY MOLLUSCA FROM NEW MEXICO AND WYOMING.

By T. D. A. Cockerell.

Plates VIII–X.

The collections obtained by the staff of the American Museum in 1912 have added to our knowledge of Western Tertiary Mollusca in several ways; while certain old specimens have been brought to light, and found to include two new Helicoid forms, one of gigantic size. The present paper offers descriptions of seven species which seem certainly to be new, and places a sixth in what appears to be its correct genus. With the exception of the great *Helix hesperarche,* which seems to be allied to West Indian forms, the new species are related, in some cases apparently closely, to the present fauna of the United States.

The question may be raised, how far we are justified in our generic determinations of fossil land shells. Frequently the characters of the shell seem quite convincing, but it must be admitted that absolute certainty is difficult to attain without the soft parts. The genus *Ashmunella,* so well developed in Arizona and New Mexico, has a shell like that of *Polygyra,* while the soft anatomy tells quite another story. Had *Ashmunella* become extinct, the species if found in the Tertiary strata would certainly have been referred to *Polygyra,* and it probably would have occurred to nobody to doubt the reference. While writing this paper, I have received from Lt.-Col. Godwin-Austin a paper on South African Zonitid snails, in which he points out that the South African species formerly referred to *Helicarion,* prove on examination of the soft parts to belong to a distinct (endemic) subfamily, with several well-defined genera. Facts of this sort point to the great antiquity of snail-faunæ, and while in one sense tending to cast doubt on our generic references of fossils, in another may be said to support them,—that is, to support the opinion that when fossil snails appear to be related to living genera of the same general region, they are actually (perhaps with some exceptions) so related.

Endodontidæ.

Pyramidula ralstonensis n. sp.

Diameter max. 7, min. 6; alt. $4\frac{1}{2}$ mm.; whorls $5\frac{1}{2}$, rounded, sutures deep; apical whorl and a half smooth, without sculpture; remaining whorls with very strong, regular, oblique riblets, about 6 to a mm. a short distance from the aperture, 11 or 12

to a mm. on the third whorl; no sign of any depressed line above the suture; umbilicus widely open, about $1\frac{1}{2}$ mm. diameter, but exposing very little of the penultimate whorl; the beginning of the last whorl shows a slight obtuse peripheral angulation, which is soon lost. There was evidently no distinct keel, even in the young.

Ralston Beds; top of red-beds. Three miles southeast of mouth of Pat O'Hara Creek, Wyoming (W. S., Sept. 22, 1912). One specimen.

A very pretty little species, with all the characters of a *Pyramidula* (subg. *Discus* Fitz.), and so far as anything shows, closely related to our modern forms. The very characteristic ribbing, the rounded whorls, the form of the umbilicus, &c. all agree; but it seems to me that the apical (embryonic) whorl is distinctly smaller than in the modern shells. Among the western fossils, "*Hyalina*" *nebrascensis* M. &. H. has a slight resemblance to our shell, but has fewer whorls, with the last whorl much deeper, and more expanded at the aperture. *Pyramidula ralstonensis* was found with a great quantity of *Goniobasis carteri* Conrad, and smaller numbers of a *Vivipara* which I cannot at present separate from *V. wyomingensis* Meek, although they are small for that species.[1] With these were also found two species of rather large helicoid shells; one, so far as its poor condition permits us to judge, appears to be *Oreohelix megarche;* the other, with broadly rounded whorls, is strongly suggestive of *Helix nacimientensis,* or of the Asiatic genus *Macrochlamys,* but better specimens are much to be desired.

Urocoptidæ.

Holospira grangeri n. sp.

Length of incomplete shell about 10 mm.; width in middle 4 mm.; ten whorls visible, first four together 2.5 mm. of the length of shell; first six, 4 mm., first eight nearly 7 mm.; apex obtuse; whorls not very convex; sculpture consisting of coarse strong ribs, 6 to 1 mm. on eight whorls; base of shell unknown.

Torrejon Formation, East Fork of Torrejon Arroyo, New Mexico, July–August, 1912 (*Granger and Stein.*)

I am really at a loss to know how to separate this from *Holospira ferrissi* Pilsbry, living today in Arizona! Were the shells perfect, no doubt differences would be found, but certainly there appears to be the closest resemblance. This is the species figured by White in Bull. 34, U. S. Geol. Survey, pl. v, f. 10, and referred by him with doubt to *H. leidyi* Meek. Figs. 8 and 9, on the same plate, also referred to *H. leidyi,* seem

[1] Genuine *V. wyomingensis* comes from the Bridger. The shells of *Vivipara* have remained for ages without substantial modification, but no doubt if we had fresh specimens, with the epidermis, color-characters and soft parts, several Tertiary species could be recognized, which are at present impossible of satisfactory definition.

to represent a different species, with finer scuplture. If either of these figures represents the real *H. leidyi,* which is very doubtful, it will be 8 and 9 (two views of the same shell).

Helicidæ.

Oreohelix (Radiocentrum) nacimientensis (*White*).

The very fine material of this species obtained by Messrs. Granger and Stein at the same time and place as *Holospira grangeri,* brings out the unexpected fact that the nuclear whorls have exactly the same radial sculpture as *O. megarche* C. & H., from which *Helix nacimientensis* differs principally in the elevated spire and rounded whorls. In typical specimens the body whorl is broadly and obtusely rounded; not angled or carinate; but the shells vary like the Jamaican *Pleurodonte acuta goniasmos* (Proc. Acad. Nat. Sci. Phila., LXIII, pls. IX, X, XI), and one specimen (var. *steini,* n. var.) has the periphery sharply angulate to the end, the shell having a max. diam. 32.5 mm. This particular specimen shows the nuclear sculpture very well, but it is also apparent on more normal shells. *Radiocentrum* was evidently the original form of *Oreohelix,* although today it includes only a few species. (*cf.* Pilsbry, Proc. Acad. Nat. Sci. Phila., 1905, p. 283.)

Polygyra (?) **petrochlora** n. sp.

Shell with diam. max. 20, min. 18.5 mm.; alt. 14 mm.; spire low-conical, about 3.5 mm.; periphery broadly rounded, not angulate or keeled; nuclear whorls smooth, the rest of shell with rather coarse very irregular oblique lines of growth, but no spiral lines, nor any depressed line above the quite deeply impressed suture; nuclear whorls rather large, diameter of first at end about 1 mm., of second (so far as exposed) no greater, but of third 1.5 mm., and of fourth, 2; whorls $6\frac{1}{4}$; aperture strongly compressed, longer than wide; peristome not well preserved, but there was evidently a well-defined thickened lip, which was reflected round the narrow umbilicus. In the type specimen, although the apex is smooth, an excessively fine radial lineolation can be detected for about 1.25 mm. about the end of the first whorl and the beginning of the second.

"Marked 'Puerco, 1896'; probably Torrejon Formation." [New Mexico.]

The four shells examined are in a greenish to bright green rock, different from that containing the other Torrejon materials. They are accompanied by a small *Unio* with very convex valves, too imperfect to describe. I have been puzzled to know where to place these shells. At first I thought to refer them to *Gastrodonta,* which they resemble in general form, the shape of the aperture, and the nuclear whorls. I am not sure that this is not their proper place, but the evidently thick lip, reflected around the narrow umbilicus, rather suggests *Polygyra* or some allied form. The irregular striation

is also more like *Polygyra* than *Gastrodonta,* the sculpture of which is regular though often strong. So far as the general form and the shape of the aperture go, the shells might well belong to the group of *Polygyra columbiana,* and they are in fact extraordinarily like the John Day fossil *P. dalli.*

Helix hesperarche n. sp.

Shell subglobose, with broadly rounded whorls; base somewhat flattened; umbilicus narrow but deep; spire very obtuse; embryonic whorls very large, but increasing slowly. Whorls about $4\frac{1}{2}$. Diam., max. 59, min. 56 mm.; alt. about 44 mm.; width of umbilicus about 7 mm.; the rather narrow aperture about 33 mm. long and 20 wide. Width of whorls at end, in mm., (1.) 4, (2.) 5, (3.) 8.5, (4.) about 11.5. The specimen is an internal cast, and nothing of the shell-structure is preserved.

"Either Puerco or Torrejon; probably Torrejon." [New Mexico]. (Amer. Mus. Nat. Hist., from the Cope collection.)

This gigantic shell, referred to *Helix* in the old broad sense, is wholly unlike anything known from the same region previously, living or fossil. It has rather a Zonitoid aspect, so far as the general build and form of aperture go. Thus in lateral view it has nearly the outline of *Macrochlamys dugasti* Morelet, from Siam, except that the outer lip of the aperture bulges less above. Seen from above, however, there is at once observed a great difference in the number of whorls and size of the nuclear whorl. I believe that the real relatives of *H. hesperarche* are the West Indian Helicidæ; thus in specimens of *Pleurodonte jamaicensis* (Gmel.) and *Thelidomus aspera* (Fér.) which I collected at Mandeville, Jamaica, I observe the very same large nuclear whorls, although the general form of the shells is different. There is, in the formation of the nuclear whorls, a striking resemblance to *Helix woodwardi* Edw. and *H. etheridgei* Edw., from the Oligocene of the Isle of Wight, which Taylor (Monog. Brit. Land and F. W. Moll., part 16, p. 205) figures and refers to the Asiatic genus *Helicostyla.* Although our shell is much broader and more depressed, with a different aperture, in its obtuse spire, rounded whorls and perhaps in the form of the umbilicus it resembles "*Helicostyla*" *pseudoglobosa* (d'Orb.) of the English Oligocene.

Helix chriacorum sn. sp.

Shell about 6 mm. diameter, helicoid, with about 4–$4\frac{1}{2}$ whorls; spire obtuse, very low-conical; sutures little impressed; last whorl broadly rounded, not at all keeled; the whole shell ornamented with very oblique sharp riblets, very regular, six to a mm. on last whorl, leaving the suture at an angle of perhaps 50°.

The label simply states "Torrejon; exp. 1912." The locality is in northern New Mexico.

A remarkable little shell, perhaps related to *Pyramidula* or *Oreohelix,* but the fine sharp riblets remind one of those on *Vallonia.*

ZONITIDÆ.

Gastrodonta coryphodontis n. sp.

Shell alt. $11\frac{1}{2}$, diam. $10\frac{1}{2}$ mm.; whorls 6; diameter of exposed part of fourth whorl about 2 mm.; apical whorl and a half, or rather more, with strong but fine regular oblique riblets, about 10 to a mm.; rest of shell with the usual rather weak oblique striæ, about as in *G. ligera*, but leaving the suture more obliquely; last whorl slightly to decidedly subangulate at the periphery, the angulation more marked in immature shells.

Five miles southeast of mouth of Pat O'Hara Creek, Clark's Fork Basin, Wyoming; above red-banded beds; probably base of Wasatch formation (*W. Stein*, 1912).

Found in quantity, with equal numbers of *G. sinclairi* (*G. evanstonensis sinclairi* Ckll.), from which it is easily distinguished by the more rapidly increasing whorls, although there is much general resemblance. Good specimens of the living *Gastrodonta intertexta* Binney (Columbia, Mo., *Dodds*) show fine sculpture on the nuclear whorls, finer than that of *G. coryphodontis,* yet essentially similar, and quite distinct from that on the rest of the shell. I therefore feel some assurance that the shell now described is really a *Gastrodonta.* I am now satisfied that *Helix evanstonensis* White is quite distinct from *G. sinclairi,* as well as from *G. coryphodontis.*

UNIONIDÆ.

Unio wasatchensis n. sp.

Shell oblong, about 60 mm. long and 33 high; moderately inflated; subtruncate anteriorly and posteriorly; umbonal region little prominent, strongly sculptured with regular undulating concentric ridges, about ten in number; ventral line nearly straight; growth lines strong; dentition not heavy. The level of the umbo is about 16 mm. from anterior end.

Wasatch; Big Horn Basin, Wyoming (Amer. Mus. Nat. Hist.). No other details given.

This appears to be the last member in the western Tertiary strata of a group of *Unio* better developed in the Upper Cretaceous. It is distinguished by the oblong or long oval form, beak, strongly sculptured with concentric ridges, and the more or less evident presence of two raised lines on each side passing from the umbo toward the posterior end. Excellent examples of this type are *Unio vetustus* Meek (Ann. Rept. U. S. G. S., 1882, pl. 7) and *Unio subspatulatus* Meek and Hayden, as illustrated by Stanton, (Bull. 257, U. S. G. S., pl. xiii, f. 1.). The dorsal raised lines are not always evident in the Wasatch species, but in some specimens they can be distinctly

seen. The cretaceous species have the dorsal outline decidedly convex, but in *Unio mendax* White, formerly confused with *U. vetustus,* the dorsal outline is straight or almost, owing to a greater development of the posterior dorsal region. *U. mendax* comes from Utah, and was found in coal bearing strata at Wales. So far as I am able to learn, it is probably of Fort Union age. *U. wasatchensis* is certainly close to *V. mendax,* but it differs constantly by the greater development of the anterior end, so that the umbones are not so near that end of the shell. It also appears to have the anterior lateral teeth considerably less massive than in *U. mendax,* though our material does not show the dentition well.

Many of the smaller shells accompanying the type of *U. wasatchensis* are long and narrow, more pointed posteriorly, suggesting some forms of the European *Uniopictorum.* As these agree in sculpture with the typical *wasatchensis,* and in the considerable series before me it appears impossible to sharply separate two groups of shells, I assume that all belong to a single species.

If, as appears probable, *U. mendax* is characteristic of the Fort Union, and *U. wasatchensis* is its successor in the Wasatch, these shells may be of considerable value in stratigraphic work.

These shells differ from typical (European) *Unio* in the beak sculpture, which is gently undulating, but not at all double-looped or zigzag. There is a general resemblance in beak-sculpture to the modern *Lampsilis ochracea* (Say) but in the fossil shells the ridges are much more numerous. It is quite possible that the fossils belong to *Lampsilis,* but in the absence of the soft parts this cannot be definitely determined.[1]

Since the above was written, two broken specimens have come to hand, with the following data: typical Knight formation; Evanston Wasatch; mouth of Stowe Creek; 200 ft. (clay); W. G., June 13, 1906. One of these specimens, although broken in front, is otherwise beautifully preserved, showing the strong sculpture and the dorsal raised lines very well. The anterior lateral teeth in these shells are large, hardly at all smaller than those of *U. mendax,* but the shape is that of *wasatchensis.*

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[1] Ortmann (Annals Carnegie Museum, VIII, 1912, p. 228) states that it is absolutely impossible to classify Najades by the shells alone. "It is true that certain types of shell are characteristic within smaller groups.... but if we come to compare the subfamilies and families, we find that various types of shell turn up in them again and again. This goes so far that certain species resemble each other so much externally that they have been confused or placed together even by our greatest authorities, while they actually may belong to entirely different groups according to the soft parts."

EXPLANATION OF PLATES.

Plate VIII.

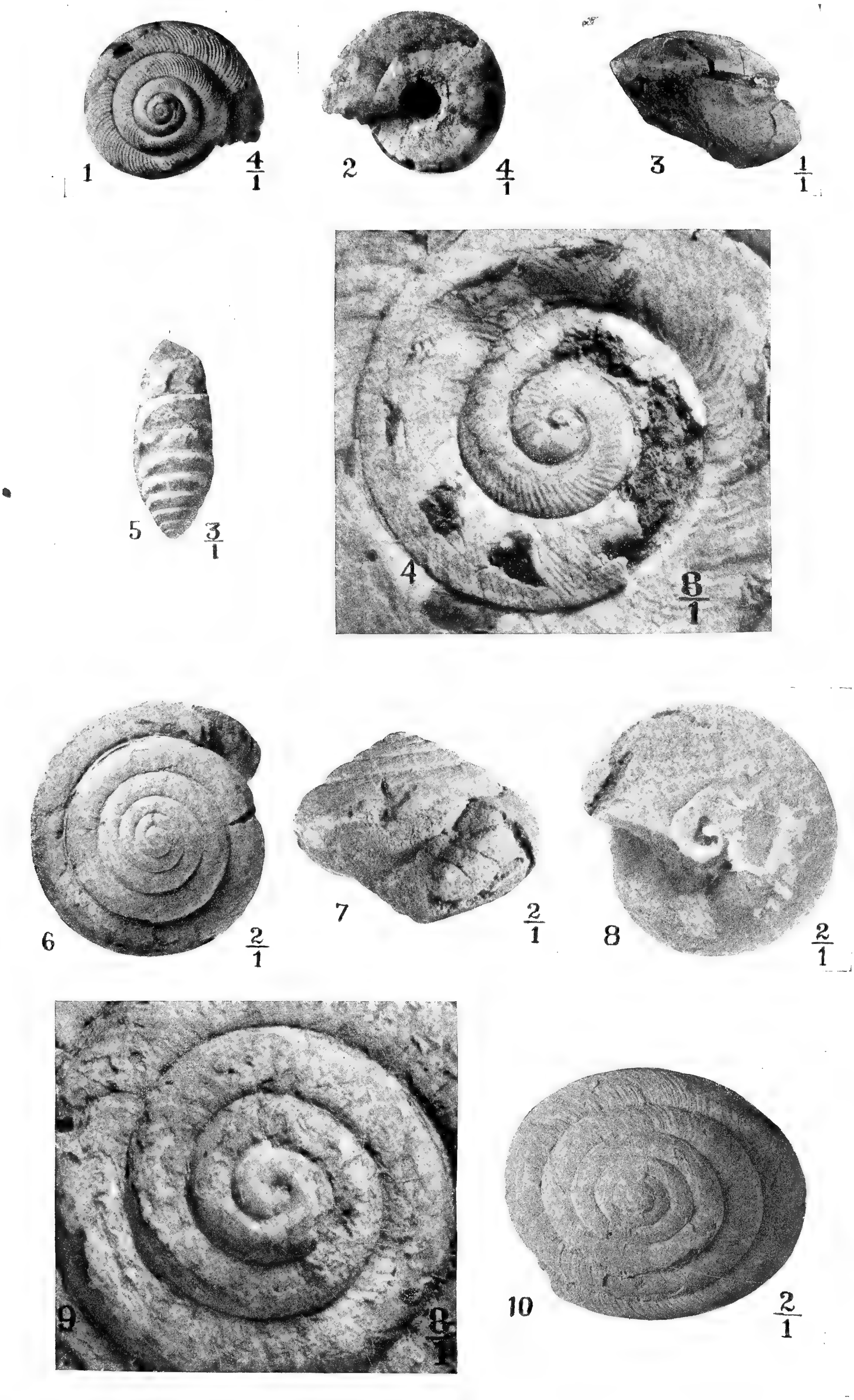
Figs. 1, 2. *Pyramidula ralstonensis.*
Figs. 3, 4. *Oreohelix nacimientensis.*
Fig. 5. *Holospira grangeri.*
Figs. 6, 7, 8, 9. *Polygyra* (?) *petrochlora.* Type.
Fig. 10. *Polygyra* (?) *petrochlora.* Cotype.

Plate IX.

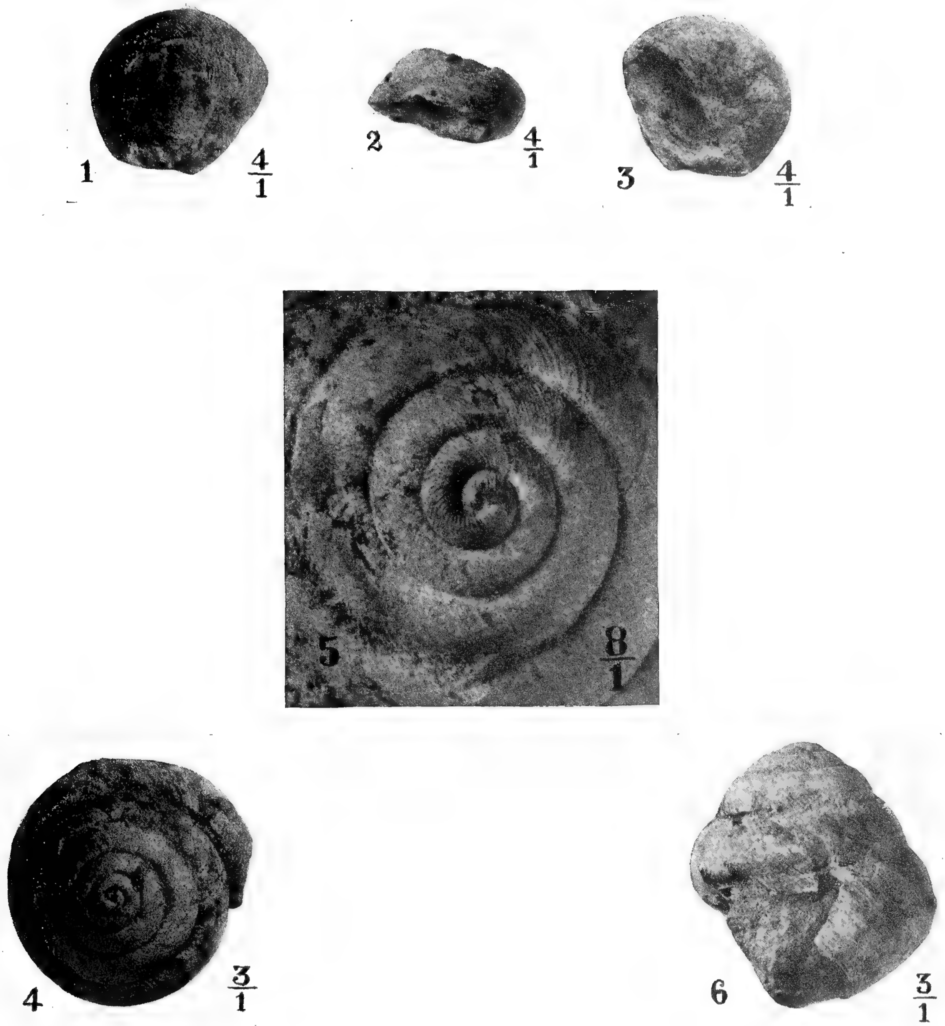
Figs. 1, 2, 3. *Helix chriacorum.*
Figs. 4, 5, 6. *Gastrodonta coryphodontis.*

Plate X.

Figs. 1, 2, 3. *Helix hesperarche.*
Figs. 4, 5, 6. *Unio wasatchensis.*



TERTIARY MOLLUSCA FROM NEW MEXICO AND WYOMING.



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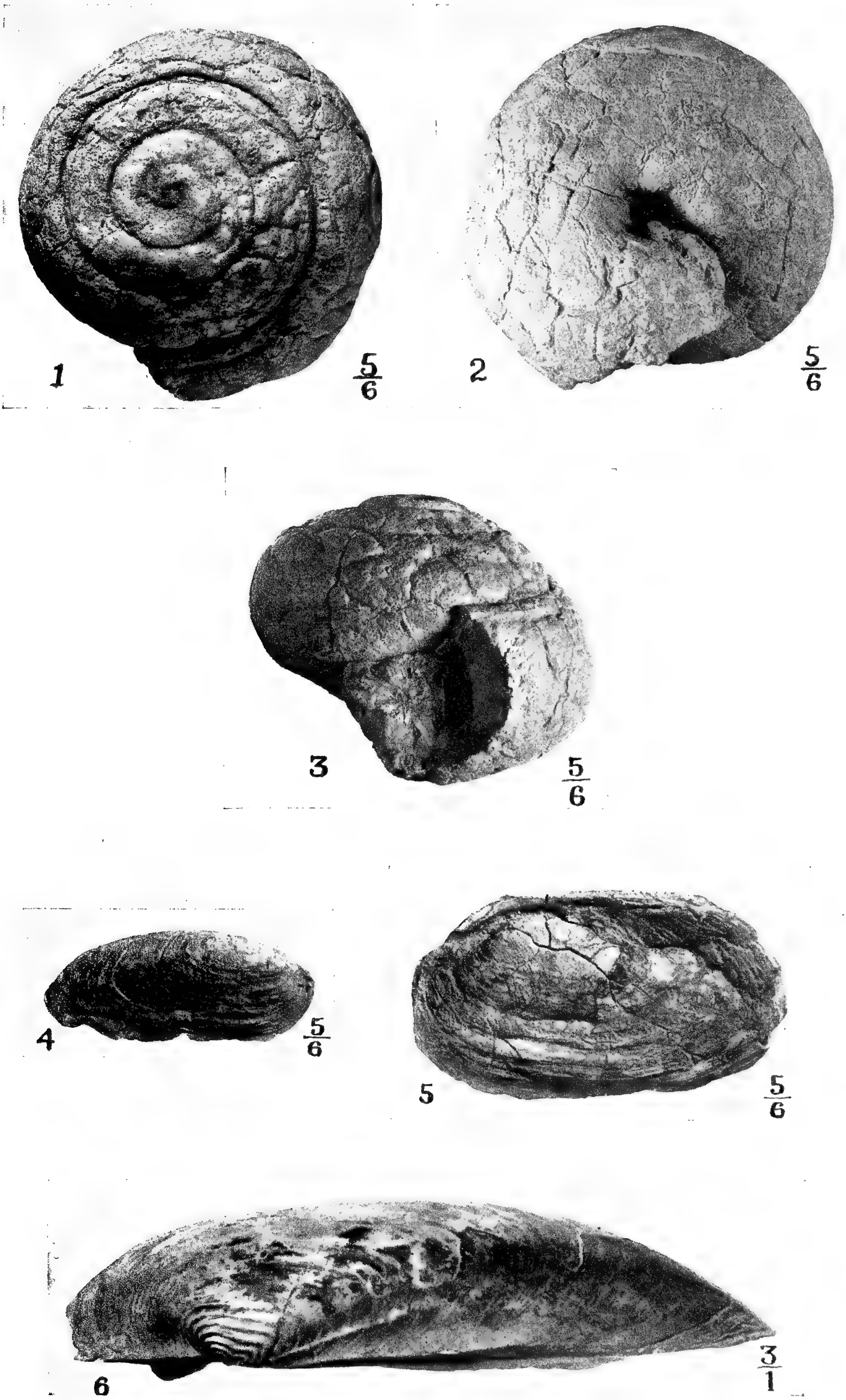

TERTIARY MOLLUSCA FROM NEW MEXICO AND WYOMING.

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Article VII.— SOME POINTS IN THE STRUCTURE OF THE DIADECTID SKULL.

By R. Broom.

The skull of *Diadectes* has been described by Cope, Case, v. Huene, and Williston, and as there are many fairly good specimens in the American Museum and other collections, most of the structure is pretty well known. There are, however, a number of points on which there is considerable doubt.

Very full accounts of the skull have been given by Case and v. Huene, and in the present paper I shall only deal with a few disputed points.

Four years ago I gave a side view of the beautiful skull in the American Museum collection, No. 4839, and indicated the sutures between the cranial elements. V. Huene in his recent paper casts doubts on the accuracy of my determinations, saying that "the skull.... shows on the outside no clearly discernible sutures, so that Broom's figures remain hypothetical." During my short visit to the American Museum four years ago, I devoted most of my time to the study of the Pelycosaurs, and only examined this one skull of *Diadectes*. In fact I was not aware that there were any other good skulls of the genus in the American Museum collection. I have recently carefully gone over again this skull and compared it with quite a number of other specimens in the collection, and find that every suture indicated in my 1909 paper is absolutely accurate with the exception of those in the post-temporal region. The skull has been prepared by having the surface smoothed off down to the bone, and as in *Diadectes* the cranial elements other than those of the occiput are not anchylosed, every suture can be traced by simply following with a lens the lines of matrix, and the only chances of error are by mistaking cracks for sutures.

One of the best skulls in the American Museum collection is that numbered 4352. Cope referred it to *Diadectes phaseolinus* in 1883 and Case in 1911 regarded it very doubtfully as belonging to *Diadectes molaris*. He gives a figure of the upper side in which the reduction is given as $\frac{3}{5}$. This is an error probably due to reduction of the original figure to suit the plate. It is more nearly $\frac{3}{7}$ natural size. V. Huene gives upper, lower, and side views of the specimen and calls it *Diadectes molaris*. If specimen No. 4350 which is the neotype of *Diadectes molaris* be correctly identified, as seems very probable, specimen No. 4352 cannot be the same species as it differs from it very greatly. Nor can it be *D. phaseolinus*. In fact it differs so markedly from all other species that I have no hesitation in making it the

type of a new species which I have much pleasure in calling *Diadectes huenei*. The skull measures 258 mm. in length, and the dental series from the root of the 1st incisor to the root of the last molar is about 137 mm. The incisors are very large, the root of the 3rd measuring 14.5 × 9 mm. The 4th is

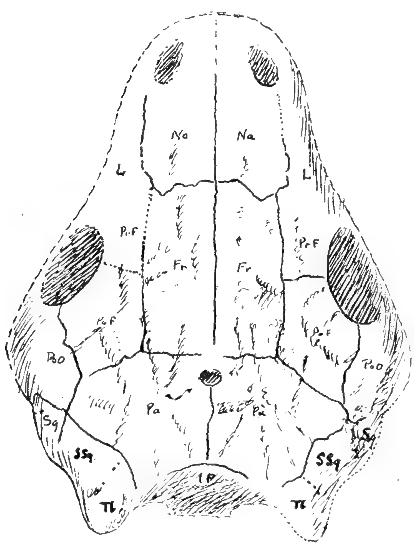

Fig. 1.

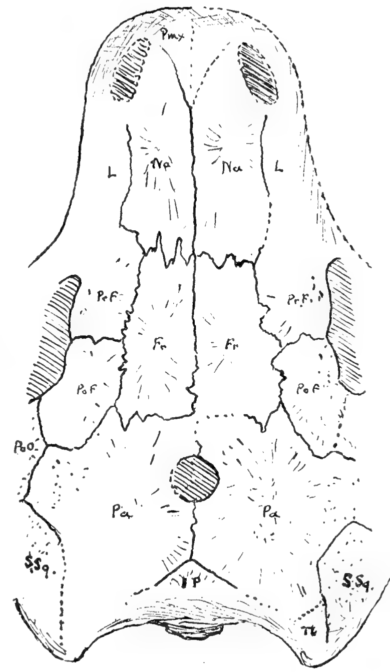

Fig. 2.

Fig. 1. Skull of *Chilonyx rapidens*. Am. Mus. No. 4357.
Fig. 2. Skull of *Diadectes huenei*. Am. Mus. No. 4378.

relatively considerably smaller. The 1st maxillary tooth is absent but the socket shows that it and the 2nd maxillary teeth were both larger than the 3rd and 4th teeth. There are altogether 12 maxillary teeth and the series measure 94 mm. The following are comparative measurements of the teeth in the 6 species represented by good specimens.

	maxillary series	5 largest teeth
Diadectes molaris Cope	68	38
Diadectes phaseolinus Cope	72	35
Diadectes fissus Cope	—	52
Diadectes latibaccatus Cope	80	33
Diadectes lentus Marsh	56 [1]	29 [1]
Diadectes huenei Broom	94	44

[1] These measurements are taken from the figure given by Case and Williston.

I have given views of the upper surface of the skulls of *Diadectes huenei* and of *Chilonyx rapidens,* another Diadectid, showing the position and rela-

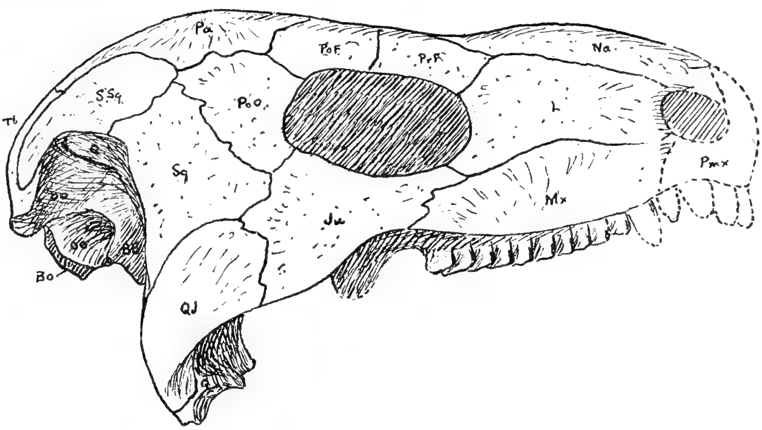

Fig. 3. *Diadectes molaris.* Am. Mus. No. 4350.

tions of the upper cranial elements. On the whole my drawings agree fairly closely with those of v. Huene.

The nasals, frontals, prefrontals (lacrymals), and postfrontals are, in my opinion, exactly as figured by v. Huene. I differ, however, as regards the parietals. In all Diadectids the parietals are very large, and pass outward and backward for a very considerable distance from the parietal foramen. The bone marked *So* (supraoccipital) is in my opinion the interparietal, and there is, I believe, no other bone between this and the parietal. This is also the opinion of Case.

The bones of the post-parietal and occipital regions are best seen in the American Museum specimen No. 4378, also figured by v. Huene and referred by him doubtfully to *Notodon lentus.* In the absence of the front of the skull, there is of course doubt about the determination of this specimen, but it agrees sufficiently closely with speci-

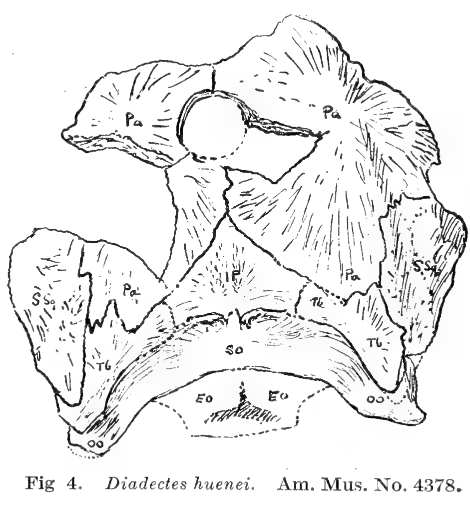

Fig 4. *Diadectes huenei.* Am. Mus. No. 4378.

men No. 4352 as to lead me to believe that it is also *Diadectes huenei.* In this specimen it is perfectly manifest that fitting in between the posterior borders of the parietal is a triangular bone which may be referred to as the interparietal. It is a single median element, but from the direction of the fibres of the bone it seems probable that it has originated from two centres of ossification. Assuming this to be the case, it would manifestly be homologous with the postparietals (dermo-supraoccipitals) of the Stegocephalians, as is also the opinion of v. Huene.

Behind the parietal and external to the interparietal, is a small bone which forms the outer posterior corner of the skull. This is manifestly the tabulare. The sutures between the interparietal, parietal and suprasquamosal and the tabulare can all be clearly made out in specimen No. 4378, and are as indicated in my figure.

External to the tabulare and the back part of the parietal is a well developed suprasquamosal. It extends about as far back as the tabulare, and forwards as far as the interparietal. In front it articulates with the squamosal. This region of the skull has hitherto been misunderstood by Case, von Huene, and myself. In the drawing of the skull which I published four years ago I took the suture between the squamosal and the suprasquamosal for a fracture and made the squamosal extend too far up and include the greater part of the suprasquamosal. In specimen No. 4378 the sutures between the suprasquamosal and the tabulare and the parietal are beautifully shown and are as I have indicated in the figure.

The structure of the occiput cannot be made out with absolute certainty owing to some of the bones being anchylosed in all the specimens, but by tracing the direction of the fibres of the bones it is possible to be moderately sure of the structure.

Below the interparietal is a large supraoccipital, separated from it by a suture. It is about equal in size to the interparietal. Laterally it is indistinguishably fused with the opisthotic but it is only very loosely articulated with the exoccipitals below — so loosely that in most specimens the basioccipital and exoccipitals are detached.

The exoccipitals are relatively very small. They form the whole of the lateral walls apparently of the foramen magnum and the outer and upper fifth of the occipital condyle.

External to the exoccipital and supraoccipital is a large opisthotic. It is fused into a single mass with the prootic and supraoccipital.

The relations of the quadratojugal, jugal, squamosal, postorbital, maxilla, and lacrymal are as shown in my previous drawing except for the correction of the suture at the upper edge of the squamosal which I have corrected in my new figure.

Case and Williston in a recent paper have called attention to "certain

errors" in my restoration. They say, "Broom shows an enlarged anterior maxillary tooth resembling a canine, a diastema, and a decrease in the size of the incisors from within outward. The character of the incisors is evidently hypothetical as they are shaded, but the arrangement is wrong as can be made out from this specimen and from several others in the American Museum. There is no diastema and in no specimen of *Diadectes* is there any indication of an enlarged maxillary. It was upon such an error that Cope founded the genus *Empedias*."

My drawing of the premaxillary was mainly hypothetical, as I had not seen any specimen, and founded the restoration on a drawing of Cope's. As there is no specimen of *Diadectes phaseolinus* known so far as I am aware, except the type and this one skull, I do not think either Case or Williston is in a position to criticize the restoration, nor is it a matter of much importance. I have since compared the restoration with all the specimens of various species of *Diadectes* in the American Museum, and there is not anything in the restoration which I would be inclined to alter except in that the fourth incisor should probably be placed closer to the canine, and the crowns of the incisors made longer and directed more forward.

With regard to the criticism of my drawing for placing an enlarged anterior maxillary tooth, I do not see any occasion for any alteration. It is a matter of very little importance whether, when the first maxillary tooth is rounded and enlarged and not molariform, we are justified in calling it a canine; but it seems to me there can be no objection in doing so, as has been done by Cope. But when Case and Williston go the length of saying that "in no specimen of *Diadectes* is there any indication of an enlarged maxillary [tooth]," they are entirely in error in a matter of fact. One has only to turn to Case's Plate 3 to see a photograph of the palate of *Diadectes phaseolinus* showing the enlarged, rounded anterior maxillary tooth, and in his text figures (Fig. 20, B and E) the tooth is even better shown. There may be a little doubt as to whether this specimen belongs to *Diadectes phaseolinus*, as at present we know nothing of the sexual variations of any of the species, and though this specimen has a larger canine than is found in the type, it may be that the one is a male and the other a female. Certainly the two specimens agree so closely in the dental measurements of the maxillary teeth as to lead one to infer that they belong to the same species. The first maxillary tooth has a greater antero-posterior diameter than any of even the largest molariform teeth. In *Diadectes huenei* the first incisor is missing but probably as large as the second, the second is very large, the third rather smaller and the fourth considerably smaller; and the first maxillary tooth, though smaller than the first three incisors, is larger than the fourth, and has a greater antero-posterior diameter than any of the molariform teeth succeeding. In the specimen which forms the neotype of *Diadectes molaris*,

the incisor teeth are small, the largest one being only about one-third the size of the largest molar, and the first of the maxillary teeth is quite small. The incisors steadily decrease in size from the first to the fourth. In a specimen, No. 4370, Am. Mus., which not improbably is *Diadectes fissus* Cope, the front incisors are large but the outer incisors steadily decrease in size to the fourth, which is quite small, and the first maxillary tooth is also quite small. In a specimen which is in my opinion *Diadectes latibaccatus* Cope, the incisors are all fairly large, the fourth only being slightly smaller than the first, and the anterior maxillary teeth are also small, though the first one is larger than the three succeeding teeth, and rounded. It would thus appear that in most specimens of *Diadectes* the first maxillary tooth, though smaller than the largest of the incisors, is larger than the two or three maxillary teeth succeeding it, and generally larger than the fourth incisor in front of it. Occasionally, as in the specimen of *Diadectes phaseolinus* which Case and I have figured, the first maxillary tooth is very distinctly larger than the immediately succeeding maxillary teeth.

Reference may be made to one or two points in the structure of the palate. There is no doubt from an examination of the palate in *Diadectes huenei* as pointed out by Huene that the median pair of toothed ridges are not entirely formed by the prevomers as I had inferred but that the posterior part is formed by the pterygoids. It is also probable that the pterygoids pass much further back than as indicated in my restoration.

In the restoration I gave of *Diadectes phaseolinus* I indicated the presence of a transpalatine (ectopterygoid), and Case has stated that in specimen No. 1078 University of Chicago "an imperfect ectopterygoid can be traced," though he failed to detect one in the Am. Mus. specimen No. 4839. V. Huene states, "Broom assumes the presence of a transverse, and I think I can verify this on skull 4352 (right) but towards the jugal I can find no suture." Case and Williston in their recent paper say, "There is no evidence of an ectopterygoid. This bone has been in question, but it seems to us there can no longer be doubt of its absence."

In the type of *Diadectes huenei* the transpalatine can in my opinion be clearly seen, the suture between it and the palatine and maxilla being quite distinct as shown by Huene, and quite as distinctly the suture between the transpalatine and the pterygoid. The suture between the transpalatine and the jugal is less distinct in this specimen but is quite distinct in specimen No. 4839 Am. Mus. though my drawing of 1909 indicates it a little too far out.

If the drawings given by Case and Williston of *Diadectes lentus* and *Animasaurus carinatus* be compared the position and relations of the transpalatine will be readily seen. In the specimen shown in fig. 1 it has been completely detached; in the specimen represented by fig. 3 it is present.

56.9,1

Article VIII.— ON THE STRUCTURE AND AFFINITIES OF THE MULTITUBERCULATA.

By Robert Broom.

Plates XI and XII.

Since the first discovery of *Plagiaulax* in 1857, there has been an almost continuous controversy as to both the habits and the affinities of the form, and with nearly every discovery of new allied forms the controversy has been continued by new workers. And it is not at all a matter to be regretted, as the more the discussion the sooner are we likely to arrive at the truth.

The very fragmentary remains which had been named *Microlestes antiquus* from the Rhœtic of Germany, and *Stereognathus oölithicus* from the Stonesfield Oolitic of England, had previously been found and though Owen discussed at considerable length their affinities, too little was known to lead to very satisfactory conclusions.

In 1857 Falconer published his first description of *Plagiaulax becklesii* and *P. minor,* giving a most detailed account of the structure of the teeth and jaws, and illustrating his paper by beautiful figures.

"That the genus was a mammal," he says, "admits of no question; that it was a marsupial is inferred for the following reasons, which are given in the order of the directness of the indications:—

"1. The compressed hatchet-shaped last premolar with the serrulated edge and parallel grooving. These characters are confined, among all known mammals, to the marsupial genus *Hypsiprymnus;* the correspondence in grooving is so exact that the number of furrows is the same in the fossils and in the recent species, with which they were compared, namely, seven; the difference, that they are diagonal in the former and vertical in the latter, being trivial and not typical.

"2. The agreement in form, relative size, and direction of the solitary incisor in the fossil rami, with that of the recent *Hypsiprymni.*

"3. The indication of the raised and inflected fold of the posterior inner and lower margin of the ramus.

"4. The form and character of the symphysical suture.

"5. The absence of any character in the jaw or teeth inconsistent with the marsupial indications."

From all the facts he places *Plagiaulax* in a "position between *Hypsiprymnus* and the Phalangers."

As regards the habits, he concludes that "as the Kangaroo rats are

strictly herbivorous, gnawing scratched-up roots, it may be inferred of *Plagiaulax* that the species was herbivorous or frugivorous. I can see nothing," he adds, "in the character of their teeth to indicate that they were either insectivorous or omnivorous."

Owen in his 'Palæontology,' published in 1860, discussed at some length the affinities and habits of *Plagiaulax* and *Stereognathus.* He came to the conclusion that *Plagiaulax* was a "carnivorous Marsupial. It probably found its prey in the contemporary small insectivorous Mammals and Lizards, supposing no herbivorous form, like *Stereognathus,* to have co-existed during the upper oolitic period." This conclusion he based on the mode of implantation of the large incisor, the carnassial character of the large teeth, the reduction of the molariform teeth, the proportions of the jaw and the "broad and high coronoid process, for the adequate grasp of a large temporal muscle," and the condyle placed below the level of the grinding teeth.

In 1862 Falconer replied at length to Owen's criticisms. He shows that *Cheiromys* has a low condyle and slightly changes from his previous position by admitting that "while regarding *Plagiaulax* to have been a phytophagous type in its affinities, we should not be justified in affirming that it may not have been a mixed feeder; it may have fed on buds or fruits, like the Phalangers; or on roots, like *Hypsiprymnus;* or on a mixed regimen of fruits and insects like the Aye-Aye."

In 1871 Owen published his 'Monograph on the Fossil Mammalia of the Mesozoic Formations,' one of the most charming of the many works of the great English master of palæontology. He figures and describes all the then known specimens of *Plagiaulax* and the upper jaw which he describes as *Bolodon crassidens.* The type of *Bolodon crassidens* is a very imperfect specimen and it is not at all remarkable that he did not suspect it to be the upper jaw of *Plagiaulax.* His remark that "had there occurred any Purbeck mandibular specimen allied to the Oolitic *Stereognathus,* it might have suggested a relationship to the maxillary evidences of *Bolodon crassidens,*" shows how singularly near to the truth he could come on the slenderest of evidence. Much of the concluding portion of his work is taken up with the reaffirmation of the carnivorous habits of *Plagiaulax* and with replying to those who maintained that it was closely allied to the rat-Kangaroos and was a herbivore. Falconer, Boyd Dawkins, Flower, Krefft, were unanimously against him. None of his contemporaries agreed with him, and even at the present time, I believe, I am the only palæontologist who is convinced that Owen was right. Owen concludes that "the affinity of *Plagiaulax* to *Hypsiprymnus,* and the concomitant assumption of the saltatorial and herbivorous character of the small extinct Mesozoic Marsu-

pial, are not demonstrated in any degree; the demonstration of the carnivority of *Plagiaulax* appears to be much more ample."

In 1879 Marsh described *Ctenacodon serratus,* a form allied to *Plagiaulax* from the Upper Jurassic of North America; and in 1880 he was able to give further details from new material. He proposed the name *Allotheria* for the order represented by *Plagiaulax* and *Ctenacodon.* While Marsh admits that the group may represent a suborder of the Marsupialia, he rather inclines to the view that "it cannot be satisfactorily placed in any of the present orders." In 1887 he described a number of other specimens of *Ctenacodon* and a number of upper jaws which he called *Allodon.* He admits the possibility of the European *Bolodon* being founded on the upper jaws of *Plagiaulax.* He believes the dental formula of *Allodon* to be i3, c0, p5, m2. He considers that the facts now seem to prove that the Allotheria are Marsupials, and that "among the various existing Marsupials, the Rat-Kangaroos, (Hypsiprymnidae) appear to be nearest to the oldest known forms represented in the order Allotheria." In a short note published in 1891 Marsh states his belief in the strong probability of *Bolodon* being founded on the upper jaw of *Plagiaulax.* Between 1889 and 1892 he published three papers giving figures of a large number of remains of Cretaceous Multituberculates, but in most cases the remains are isolated teeth and bones and it is difficult to be at all sure of the association. Still the remains are extremely important.

In 1884 Cope published an important paper on 'The Tertiary Marsupialia' in which he discussed the structure of *Polymastodon, Ptilodus,* and *Neoplagiaulax,* and their relations to *Tritylodon, Plagiaulax, Ctenacodon,* and *Thylacoleo.* He regards all these types as belonging to a suborder of the Marsupialia, to which he gives the name Multituberculata. He discusses briefly the habits of *Ptilodus* and *Thylacoleo,* and while he says that "it is difficult to imagine what kind of vegetable food could have been appropriated by such a dentition as that of *Ptilodus* and *Thylacoleo*" he admits the possibility of the large teeth having been for cutting "off pieces of fruit and other soft parts as suggested by Professor Flower," but considers it as "clearly inadmissible" that they could have been herbivorous in the manner of existing kangaroos. He makes the suggestion that the diet of *Ptilodus* "may have consisted of small eggs which were picked up by the incisors and cut by the fourth premolars," while *Thylacoleo,* he thinks, may have fed on "larger eggs, as those of the crocodiles, or even the weaker living animals."

Owen in 1884 described the anterior part of a skull from the Lower Jurassic beds of Basatoland, S. Africa, under the name *Tritylodon longaevus.* This type and only known specimen consists of a somewhat rodent like

snout with, on each side, a large rounded incisor followed by a smaller one, and then after a long diastema as in rodents certainly six, probably seven, multituberculate teeth with tubercles arranged in 3 rows not unlike the teeth of *Stereognathus*. Owen regarded the specimen as a mammal allied to the earlier known English type. For many years no one ever questioned the fact of *Tritylodon* being a mammal, but in 1894 Seeley advanced the view that it was Cynodont reptile. In 1905 I endeavoured to show that the arguments advanced by Seeley were invalid, and that *Tritylodon* was a true mammal whose "affinities seem to be more with the Monotremes than with the higher forms."

With regard to the name to be used for the group we have the choice of the two terms Allotheria and Multituberculata. Were the matter to be decided by priority there is no question that Allotheria must be used; but rules of nomenclature do not seem to demand such strict adherence to priority as in the case of genera and species, and there is the serious objection to Allotheria from the termination "theria." The mammals are subdivided by Gill and Huxley into subclasses for which the termination "theria" has been used, and as I hope to show that the Multituberculates are a subdivision of the *Prototheria,* it would seem improper to use the term Allotheria as an Order of the Prototheria. The name Multituberculata is moreover well established and very appropriate.

In 1888 Osborn published his monograph on 'The Structure and Classification of the Mesozoic Mammalia' in which he reviews all that has previously been known of the Multituberculata and gives much new information on the type specimens, most of which he had personally examined. He describes a very fine, nearly perfect upper jaw of *Bolodon,* of which he gives the dental formula as i2, c0, p3, m4. He regards the Bolodontidæ as forming a separate family of the Multituberculata. While placing the Multituberculata with the Marsupials, he admits the possibility of their being related to the Monotremes, and even goes so far as to say "whether they are to be considered as a branch of the monotreme or of the marsupial stock is an unsettled question."

Between 1891 and 1893 Osborn published three other papers dealing with the Multituberculates in which he deals chiefly with the Cretaceous genus *Meniscoessus.*

Till 1888 every writer, so far as I am aware, agreed that *Plagiaulax* and its allies were Marsupials, though Osborn expressed doubts as to their being Diprotodonts, and all except Owen agreed that *Plagiaulax* was not a carnivore. In this year Poulton discovered that *Ornithorhynchus* has in the young condition teeth which have irregular crowns slightly suggesting the molars of *Microlestes* and *Plagiaulax,* and Cope in commenting on the discovery

said, "it renders it extremely probable that the *Multituberculata* are *Monotremata*, and not *Marsupialia*." Thereafter he divided the Prototheria into three suborders, Protodonta, Multituberculata, and Monotremata.

Since 1888 the authorities have been divided, some holding that the Multituberculata are Prototherians, others that they are Marsupials, neither side being able to supply very much evidence in defence of their position.

In 1909 the first good skull of a Multituberculate was described by Gidley, who concluded from the many resemblances to the appearances presented by the typical Diprotodonts that *Ptilodus* and the other allied forms are Diprotodont Marsupials. This conclusion was accepted by most, including Osborn, and Scott.

Gregory in his 'Orders of Mammals,' published in 1910, while agreeing that the "Multituberculates" are Marsupials, is not convinced that they are true Diprotodonts for the following reasons:—"(1) because so far as indicated by Marsh's *Allodon fortis*, the enlarged incisor in Multituberculates is i^2, whereas in Diprotodonts it seems to be i^1; (2) because the Multituberculates differ greatly from the true Diprotodonts in the character of the cheek teeth; because homoplastic resemblances, especially among related groups, is so frequently shown in the dentition." In the table that he gives on p. 229, however, he derives the Multituberculates quite independently of all the other mammals from a Triassic Prototherian ancestor.

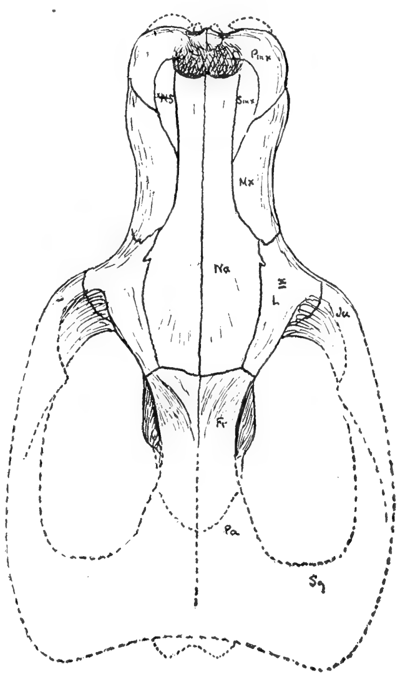

Fig. 1. Skull of *Tritylodon longævus* Owen. $\times \frac{2}{3}$. The front portion is very slightly restored from the only known specimen. The back portion is entirely hypothetical.

In 1910 I published a paper 'On *Tritylodon* and the relationships of the Multituberculata,' in which I argued that there were strong reasons for doubting their being Diprotodont Marsupials and no conclusive evidence of their being Marsupials at all had been advanced by Gidley. It was pointed out that the Diprotodont Marsupials as we know them today have sprung from a Polyprotodont ancestor, and that there is good reason for believing that the Polyprotodonts

are not older than Cretaceous times, and that hence the Multituberculates, which can be traced back to Triassic times, cannot be at all nearly related. The conclusion to which I came was that "in the present state of our knowledge it seems wisest to leave the Multituberculata as a distinct independent group with no very near affinities with the living Monotremes, Marsupials or Eutherians." I regarded *Tritylodon* as in habit a root-eating animal.

As regards the structure of *Tritylodon* the following are some of the more important characters seen in the only known specimen:—The dental formula is probably i3, c0, p4, m3; the molariform teeth have three rows of cusps and the lower teeth have worked against them with an anteroposterior movement; the lacrymal is very large; the frontal region of the skull very narrow; there is a large septomaxillary, and evidence of at least a rudimentary internasal process of the premaxillary; the nasal is very long and very wide behind.

I have given a restoration of the skull showing what appear to me to be the probable proportions of the posterior part.

Plagiaulax *Falconer* and **Ctenacodon** *Marsh.*

Most of the known specimens have been very fully figured, and until further specimens are obtained little more can be made out with certainty. It may, however, be worth discussing the possibility of *Bolodon* being founded on the upper jaw of *Plagiaulax.* This possibility was suggested by Marsh and by Smith Woodward but by most *Bolodon* is regarded as belonging to a different family. Still it seems remarkable that a number of mandibles of *Plagiaulax* are obtained in a certain locality with no trace of any maxillary remains, and in the same locality a number of maxillaries of *Bolodon* with no trace of any mandibles.

In the case of the American Upper Jurassic genus *Ctenacodon,* a near ally of *Plagiaulax,* we have an upper jaw which Marsh quite confidently refers to the same genus, and a second type of maxilla which has been named *Allodon,* which, though different, is clearly allied, and I think it belongs to the same family, but if we assume that *Allodon* is a Plagiaulacid, *Bolodon* must also be.

The third well known upper jaw of manifestly the same type as *Bolodon* is Cope's *Chirox.* It has three premolariform teeth and three more complicated molars, and I think there can be very little doubt that the 6 teeth of *Chirox* are homologous with the posterior 6 teeth of *Bolodon.* Gidley's discovery of the complete skull of *Ptilodus* shows that *Chirox* is founded on the upper jaw of *Ptilodus,* and renders it extremely probable that *Bolodon*

is founded on the upper jaw of *Plagiaulax.* If we assume this we must regard the Plagiaulacids as having at least 3 molars in the upper jaw or we have to consider that *Bolodon* has 5 premolars as has been done by Marsh. Now we know of no recent mammals, if we except a few extremely modified types such as *Orycteropus* and *Tatu,* that have more than 4 premolars, and as even the Cynodont reptile *Diademodon* has 4 premolars it seems so extremely probable that primitive types such as *Tritylodon* and *Bolodon* which have 7 molariform teeth have 4 premolars and 3 molars that one would require very positive evidence to the contrary to believe otherwise. So far as I am aware the only reason why such a view is not universally held is that in the lower jaw there are only two molariform teeth, and the grooved tooth in front of the two manifest molars in *Plagiaulax* and allied genera looks like the grooved tooth in some Diprotodont marsupials which is manifestly a premolar. When it was believed that *Plagiaulax* was allied to *Hypsiprymnus* as was held by Falconer and so many others it was natural to assume that the large grooved teeth in the two genera were homologous, but even if it could be proven that the Multituberculates were Marsupials there would be quite as good reason for comparing the *Plagiaulax* tooth with the grooved tooth in *Abderites* where it is certainly the 1st molar. But as in my opinion the grooved teeth of *Hypsiprymnus, Abderites,* and *Plagiaulax* have all been quite independently evolved the nature of the teeth in these other genera need not concern us in our study of the *Plagiaulax* problem. There seems to me to be only two possible interpretations of the dental formula of *Plagiaulax* (Bolodon) — either that the formula is $\frac{p4}{p2}, \frac{m3}{m3}$ or $\frac{p3\ m4}{p1\ m4}$ and of these the former seems much the more probable. If we assume this to be the correct formula for *Plagiaulax* the complete dental formula for the more primitive *Plioprion* would probably be $\frac{i3}{i1}, \frac{c0}{c0}, \frac{p4}{p3}, \frac{m3}{m3}$ and this is probably also the formula for *Ctenacodon,* though not improbably it may have an upper canine.

Ptilodus *Cope.*

By far the best known of the Multituberculata is the genus *Ptilodus* Cope, and most of our knowledge we owe to Gidley, who has described a beautiful skull and a number of the other parts of the skeleton which are preserved in the United States National Museum, Washington. Gidley's description leaves little to be desired, and though on one or two points I differ from him, both in regard to the interpretation of structures and as to the affinities of the group, I feel I must express my views with considerable hesitation. Still, as I incline to differ from him in one or two points, I

think it well to state those points so that future workers may have their attention called to them.

The skull has been very satisfactorily illustrated, and shows comparatively little that is not seen in the figure. There is one little point to which attention might be called. The back of the lower jaw, which is shown in the side view of the skull, has the coronoid region supported by plaster, and if the figure be copied as it stands, and as has been done by Scott in his recent book, a misleading idea is given of the shape of the coronoid process. Gidley's figure "b" shows correctly the shape of the coronoid process, as does also his text figure (fig. 8).

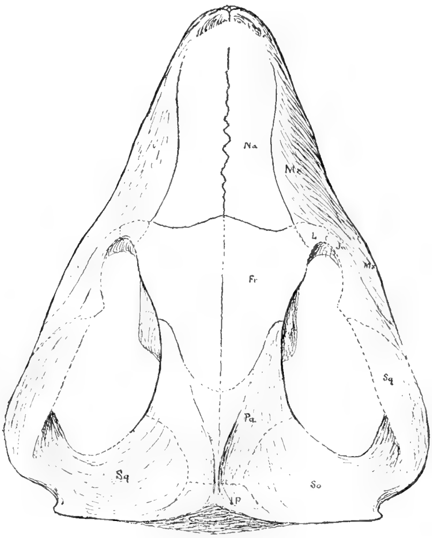

Fig. 2.

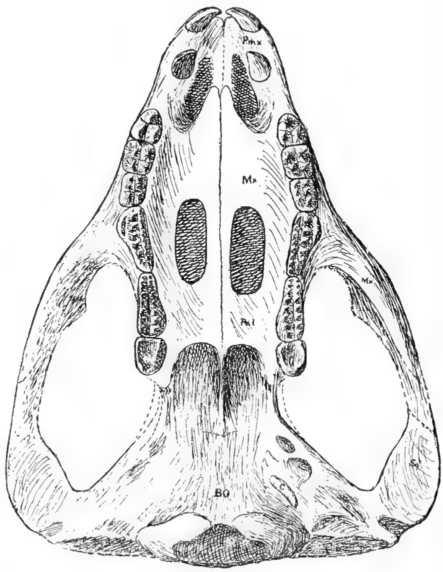

Fig. 3.

Fig. 2. Skull of *Ptilodus gracilis* Gidley. Slightly restored. Slightly less than $\frac{2}{1}$.
Fig. 3. Skull of *Ptilodus gracilis* Gidley. Palatal view slightly restored. Nearly $\frac{2}{1}$.

Gidley has correctly described the large nasal and even in the figure he gives the sutures are roughly indicated. The frontal is moderately large and in the restoration of the skull which I give, it will be seen to be partly overlapped behind by the forward extention of the lateral parts of the parietals.

The sutures between the squamosals, parietals, and interparietals cannot be made out, but are probably as I indicate.

The zygomatic arch is formed by a large anterior process of the squamosal and a well developed posterior process from the maxilla, with possibly a

relatively small jugal between. The exact limits of these elements in the arch cannot be seen with certainty as both arches are crushed and imperfect. There can, however, be no doubt that the maxillary and squamosal portions of the arch are both large, and I do not think that the jugal enters the glenoid facet.

The under side of the skull shows one or two points of interest. In front of the palatine portion of the maxilla there is evidently a very large anterior palatine foramen, and the front part of the maxilla is curiously excavated as if it retained a large nasal floor cartilage. The region of the skull between the posterior nares and the basioccipital is unfortunately slightly crushed, and it is extremely difficult to be at all certain of the structure. Pretty manifestly the vomer extends backwards some distance behind the edge of the secondary palate. The pterygoids, or transpalatines, are probably lost. In the figure I give I have indicated what looks like two large foramina in the alisphenoid region. Between the front of the alisphenoid region and the occipital condyle is what I believe to be the cast of the cochlea. I think there can be little doubt that this determination is correct, and also that the cochlea is of the typical monotrematous uncoiled form. The occipital condyle is not unlike the condyle of the marsupials or the monotremes. One very important point is that there appears to be only one foramen for the XIIth nerve. With regard to the tympanic region little can be said with certainty owing to the crushed and imperfect condition of the specimen, but there appears to me to have been no alisphenoid bulla, the structure of this region probably being not unlike that in *Ornithorhynchus*. In my opinion it cannot have been like that of any marsupial.

I have little to add to Gidley's description of the postcranial skeleton except in regard to what he believes to be the pelvis. The bones look so like ilia and ischia that I feel sure nine out of every ten who examine the specimen will agree with Gidley and it is therefore with considerable hesitation that I venture to give it as my opinion, that more probably they are the scapulae and coracoids.

In the specimen as preserved there are two girdles lying almost side by side and the right femur lies by the side of one, the whole being strikingly like the two sides of the pelvis with the femur almost in articulation with its corresponding acetabulum. A careful examination of the two girdles shows, I think, quite conclusively that the one is the right and the other the left side of either the pelvis or shoulder girdle. For convenience in discussing the structures I shall refer to the one figured by Gidley as girdle A and the other one which he has not figured as girdle B.

I have given three figures of girdle A and two of girdle B, drawing them natural size and as carefully as possible with camera lucida. Girdle

A shows an upper long moderately straight bone which has at its lower end an articular cavity. Continuing downwards the upper bone is joined to a

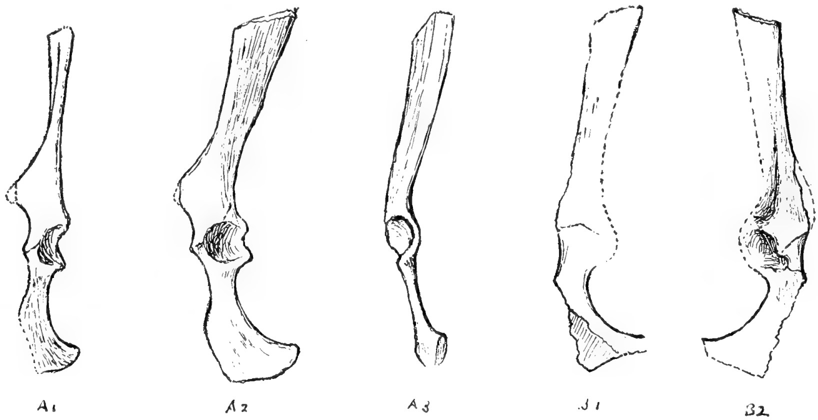

Fig. 4. A1, A2, A3, views of Girdle A. B1, B2, Views of Girdle B. All nat. size.

much shorter and much curved lower element. In front of the upper bone there is a somewhat folded anterior process.

If we look upon the girdle as is done by Gidley as the pelvis girdle A must manifestly be of the left side, and the pubis we must regard as lost. What would correspond to the pubic border of the bone is slightly imperfect in the specimen and this girdle alone would hardly be sufficient to settle the question whether a pubis had been attached and broken off. We may regard it as quite certain that the very curved border of the lower element gave no attachment to any other bone.

Girdle B is slightly less perfectly preserved and the lower element has been slightly crushed and displaced. When an accurate drawing of the lower element of this girdle is laid on a drawing of the lower element of girdle A it is quite manifest that whatever the element is in the one it is the same in the other. If we assume that it is the ischium of girdle A then girdle A must be the left pelvis

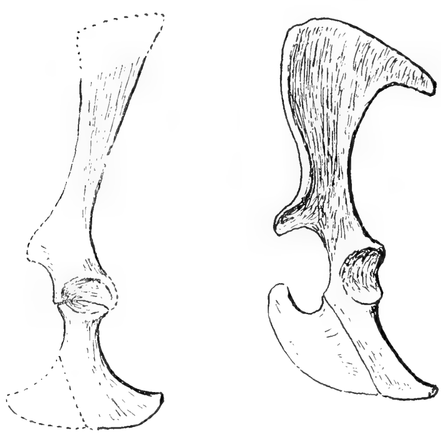

Fig. 5. Supposed shoulder of girdle of *Ptilodus gracilis* Gidley for comparison with the shoulder girdle of *Ornithorhynchus anatinus* Shaw.

and girdle B the right. If now we look at the drawings of girdle B assuming that the long element is the ilium and the short the ischium we require to fit the pubis on the side away from the curve of the supposed ischium, but while the specimen is a little imperfect and crushed it shows this, I think, at least clearly that no pubis or other element has been attached near the articular cavity on the side away from the ischial curve. The surface here of the bones is smooth and rounded. It does look as if there might be a small element intercalated between the upper and lower bones by the side of the articular cavity but this cannot possibly be the pubis and appears to be merely a fractured portion of the upper element. In neither girdle in the specimen as preserved was any portion of what might be regarded as a pubis present though the rest of the girdle is well preserved.

The conclusion to which I come is that the girdles are the right and left shoulder arches. The long element I believe to be the scapula and the curved lower one the coracoid. I give a figure slightly restored of the girdle as I interpret it. The anterior flattened process is, I believe, the acromion. The glenoid cavity is large and rounded and the scapular articular surface has been extended backwards a short distance. Though this backward development of the articular surface is lost from specimen A Gidley has indicated it in dotted line and in specimen B it can be still fairly well seen.

If the whole girdle be compared with the shoulder-girdle of *Ornithorhynchus* it will be seen that the structure of the two agrees fairly closely. The scapula of *Ornithorhynchus* is very curiously twisted to suit the peculiar digging and swimming habits of the animal. In *Echidna* there is much less twisting of the scapula and in the Anomodonts such as *Dicynodon* the scapula is a straight flattened bone not at all unlike the scapula of *Ptilodus*.

The element which I regard as coracoid is not at all unlike the coracoid of *Ornithorhynchus* and very likely there was a distinct precoracoid bone as in the monotremes.

Many years ago Marsh figured some bones which he regarded as probably belonging to one of the Multituberculates and named by him *Camptomus amplus*. These include the lower end of a scapula with an articular facet for a distinct coracoid and a very much more remarkable bone which he refers to the same species and which is manifestly correctly identified as an interclavicle. As a large number of the Cretaceous remains which he describes from the same beds are those of Multituberculates it seems probable that the association of at least this interclavicle with a Multituberculate is correct. Any animal which had an interclavicle like the one figured must have had a large coracoid articulating with the sternum and even if we did not know that an interclavicle of this type had been found we could have predicted that any mammal which had a large coracoid articulating with the sternum was likely to have an interclavicle.

The association of the femur with what I regard as the shoulder girdles is, I believe, purely accidental. The few bones of the skeleton of *Ptilodus* were found separate and mixed up in the matrix and there is no trace of the sacrum.

Polymastodon *Cope.*

Polymastodon, though described by Cope as early as 1878, from a fragmentary skull and lower jaws, and though known later by many other fragmentary specimens, has until now never been very satisfactorily known. The teeth are usually well preserved, and have been very fully described. There are two incisors in the upper jaw, a large pointed one which is proba-

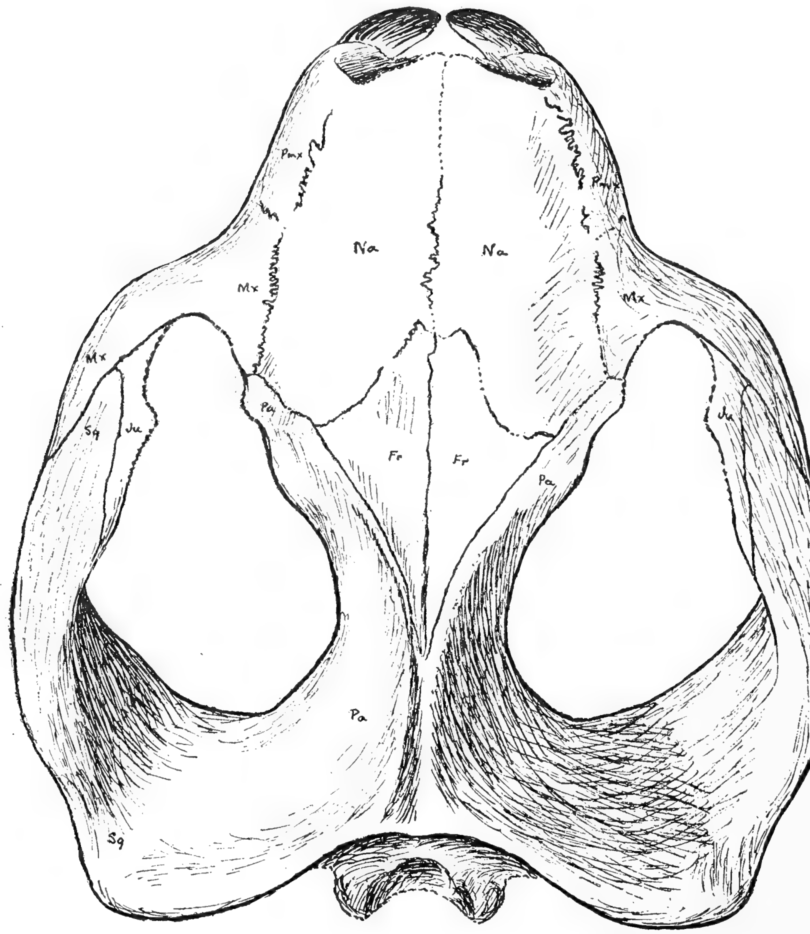

Fig. 6. Skull of *Polymastodon taoensis* Cope. $\frac{2}{3}$ nat. size.

bly i2, and a small pointed tooth behind it which is probably i3. There is no canine and the post-canine teeth are represented by two large multituberculate molars and a small tooth with a flattened edge and two roots, which is situated in front of the larger tooth. In the lower jaw there is a single incisor and three molars, of which the first is a small, flattened tooth like the small tooth above, and the two posterior molars resemble somewhat the upper teeth, but differ in having two rows of cusps instead of three. A number of skeletal remains have been figured and described by Cope, but there is some doubt as to whether these belong to *Polymastodon,* one bone at least being almost certainly not of *Polymastodon.*

The recent expedition of the American Museum to the Puerco beds of New Mexico was fortunate in finding a number of fresh specimens of *Polymastodon,* the most important of which is nearly a complete skull found by Mr. W. J. Sinclair about two miles east of Ojo Alamo. The specimen though found broken up in small fragments, has been fitted together by Mr. W. Granger and forms a skull complete except for the basioccipital, basisphenoid and some other portions of the base. The upper surface, though imperfect in a few minor details, shows almost all the sutures clearly in the greater portion, and thus reveals for the first time the structure of the skull in a Multituberculate.

Professor Osborn and Dr. Matthew have done me the great honor of asking me to describe this new skull.

The skull is unusually short and broad, the orbits are very small and not separated from the temporal fossa, which is extremely large. The zygomatic arch is unusually stout. The squamosal passes well back and the glenoid cavity is probably in a line with the front of the basioccipital, the articular region thus being much further back than in typical mammals.

The nasals are very broad both in front and behind, but somewhat broader behind. They articulate with the frontal and the parietal posteriorly, and laterally with the maxilla and premaxilla. The premaxilla is well developed and not unlike that of a rodent, it having a long suture with the maxilla posteriorly and a long suture with the nasal above. There appears to be a distinct palatine process to the premaxilla, though this region is unfortunately imperfect and the extent of the palatine process cannot be made out, nor the size of the anterior palatine foramen.

I fail to find any septo-maxillary, though a loose one may readily have been present and lost.

The maxilla is unusually large, forming not only the greater part of the palate but much of the side of the face and about two-fifths of the zygomatic arch. Above, it extends up to the nasal and also meets the parietal, completely shutting out the frontal from the orbital margin. It probably forms

most of the front of the orbit, and certainly forms its middle portion. The zygomatic portion has a long articulation with the squamosal, completely shutting out the jugal from the lower border of the arch. The palatal portion is moderately entire, there being only a small oval vacuity.

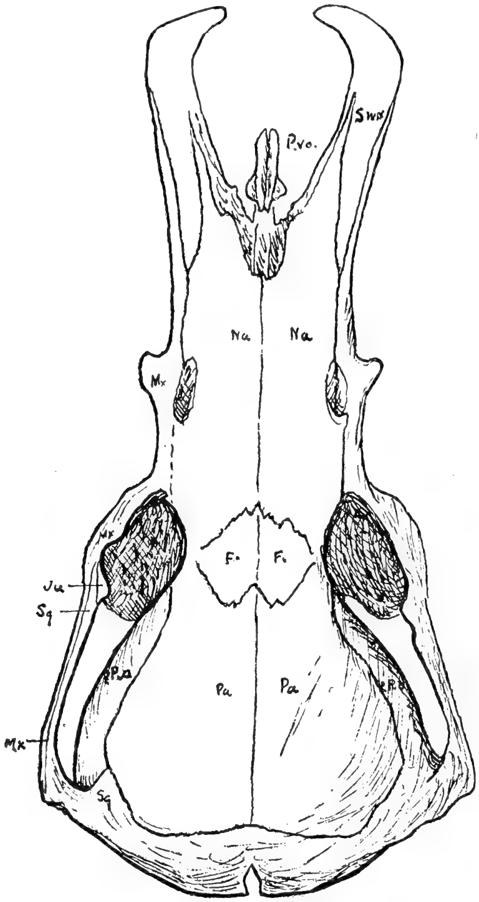

Fig. 7. Skull of young *Ornithorhynchus anatinus* Shaw. $\frac{3}{2}$ nat. size. Modified from v. Bemmelen.

The jugal is unusually small and rests on the upper border of the zygomatic portion of the maxilla and squamosal. Though imperfect, it must be practically as I have restored it. The slender back portion is perfectly preserved, and is seen to be merely a narrow splint of bone. The front portion probably had a postorbital process and certainly did not reach far round the anterior orbital margin, as shown by another specimen.

The frontal bone is quite unlike that known in any other mammal, being completely shut off from the orbit by the parietal and the nasal, and in being unusually small. The two together form a diamond shaped area on the top of the skull, the front two sides being bounded by the nasals and the posterior two by the parietals.

I can find no trace of a distinct lacrymal bone. If one occurs, it must be very small and situated low down within the orbit.

The parietal is a large bone which forms the whole of the inner margin of the temporal fossa. In *Polymastodon* the brain is exceedingly small and the parietal region is narrow and the bone so exceedingly thick that no indication of the size of the brain cavity is given by the upper view. The wide interorbital region is probably entirely occupied inside by the nasal

cavity and air sinuses. The back part of the parietal is indistinguishably fused with the squamosal and interparietal, the whole bone being very massive. Anteriorly, the parietal sweeps forward to the orbital region, articulating with the frontal, nasal and maxillary.

The squamosal is extremely large and besides forming a large part of the cranium proper, it has a powerful anterior zygomatic portion which meets the maxilla in front and on whose upper anterior portion rests the small jugal.

The occiput is very large and broad, but in only one place can any trace of a suture be seen. This is a transverse suture dividing what is probably the lateral portion of a large interparietal above from what may be opisthotic below it.

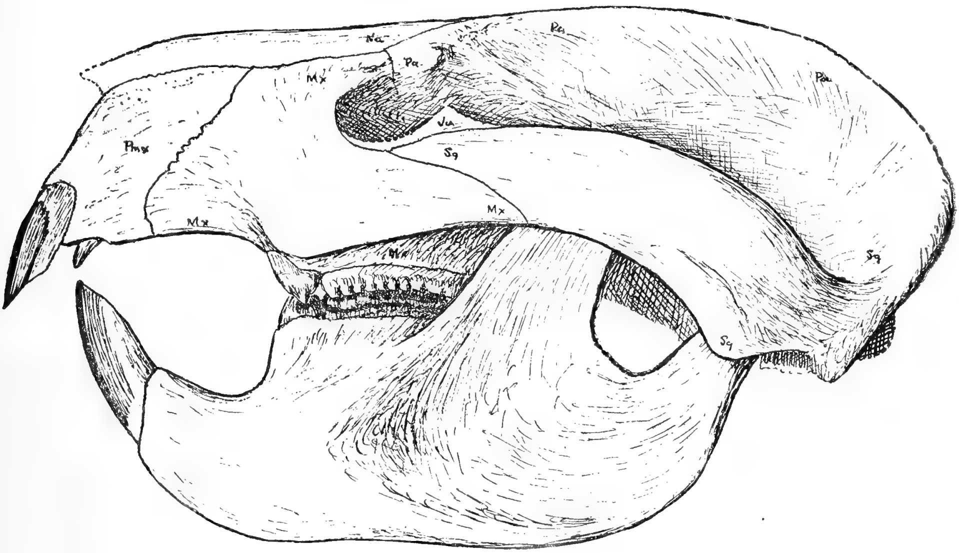

Fig. 8. Skull of *Polymastodon taoensis* Cope. $\frac{2}{3}$ nat. size.

The mandible of *Polymastodon* has previously been pretty well known though to one or two points may attention specially be called. By the large majority of writers the "inflected angle" of the Multituberculates has been brought forward as a Marsupial character. As I pointed out in a previous paper when I had only figures to go by I could not persuade myself there was anything but a very remote resemblance in this character between Marsupials and Multituberculates. In all Marsupials there is a well marked angle to the jaw which passes backwards, downwards and inwards and ends in a sharp process. In some it passes backwards behind the plane of the articulation: in some it is only slightly inflected. In neither

Plagiaulax, Ptilodus, nor *Polymastodon* is there any proper angle at all. There is an inflected border or ridge lying along part of the posterior half of the inside of the jaw, but one has only to compare a jaw of *Ptilodus* or *Polymastodon* with that of any Marsupial to see how very unlike they are. There is no doubt that the borders are homologous but owing to the ex-

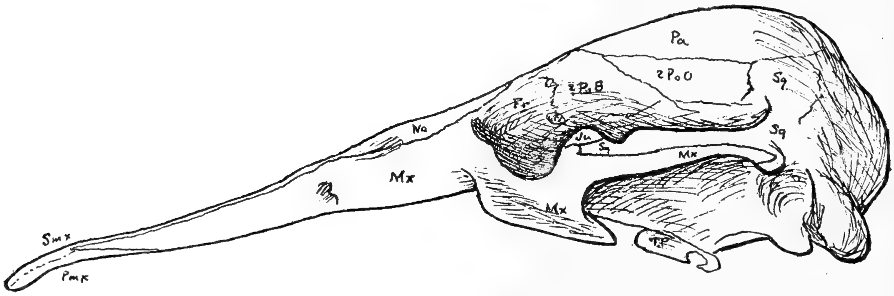

Fig. 9. Skull of young *Ornithorhynchus anatinus* Shaw. $\frac{3}{4}$ nat. size. Modified after v. Bemmelen.

tremely backward position of the articulation in the Multituberculates the internal pterygoid muscle has to be inserted further forward on the jaw. The condition of affairs in the Multituberculates is really essentially more like that in *Ornithorhynchus.*

The two jaws were rather loosely attached at the symphysis.

Affinities of the Multituberculata.

Though three well marked types of Multituberculates are known only two are represented by fairly good skulls and the third by a snout.

Tritylodon the oldest known type represented by more than isolated teeth is unquestionably also the most primitive in structure. It differs from Marsupials very markedly in the dentition — the enlarged i2, and the seven multitubercular molariform teeth, in having a well developed septomaxillary, and from most in the large size of the lacrymal. It resembles Monotremes in having a large septomaxillary, and differs from them in possessing a large lacrymal, but little can be done in the way of comparison as only the preorbital part of skull of *Tritylodon* is preserved, and the preorbital part of the skull of both known Monotremes is extremely specialised. It is almost as difficult to institute a comparison with the Cynodonts, the evidence so far as it goes seems to show that *Tritylodon* is not very nearly related to the Cynodonts, and I am of opinion that when a good skull is obtained it will prove *Tritylodon* to be a mammal more similar to living monotremes and marsupials than to the typical Cynodonts.

Plagiaulax and *Ptilodus* are doubtless members of a common family, and though *Ptilodus* occurs so very much later in time it differs from the older form surprisingly little. The large majority of palaeontologists from Falconer and Owen to Gidley have regarded the Plagiaulacidae as a family of the Diprotodont Marsupials. Practically the only arguments advanced by the early writers in favour of this view were the resemblance of the large cutting tooth in the lower jaw to the last premolar in *Hypsiprymnus* and other Rat Kangaroos, and the fact that the Plagiaulax mandible has a somewhat inflected angle. Gidley advanced the additional argument from the skull he discovered of the marsupial-like perforations of the palate. As I pointed out in my previous paper none of these arguments is of very much weight. Perforations of the palate are found in *Macroscelides* and *Erinaceus* among the Eutheria. The large grooved tooth of the Plagiaulacids is much more likely to be the 1st molar than the last premolar, and to be thus not homologous, but the result of convergence. And the inflected angle of the Plagiaulacid jaw is so very unlike the angle of the jaw of marsupials that one hesitates to call it even convergence. The Plagiaulacids might almost be said to have no proper angle to the jaw at all but only an inflected border which is not produced backwards to form an angle.

The zygomatic arch of *Ptilodus* is unfortunately too much fractured to render the structure quite certain. There can however I think, be no doubt that the maxilla and the squamosal form the greater part. In the restoration I give I have represented the jugal as separating the maxilla from the squamosal, but it is quite possible that this middle portion is either maxilla or squamosal and that the jugal is only on the upper side of the arch as in *Polymastodon.*

The most important characters in *Ptilodus* as pointing to the affinities are the uncoiled cochlea and the presence of a large coracoid.

Polymastodon, though later in time than *Plagiaulax* and considerably specialized, throws much additional light on the affinities of the group. The skull is quite unlike that of any other known mammal. Possibly some of the peculiarities are due to specialization. For example we find in some rodents a very marked reduction of the jugal with an increase in size of the zygomatic portion of the maxilla. In *Fiber* the maxilla nearly reaches the squamosal and in *Castor* and others the lacrymal is small and mainly situated within the orbit. We even find in *Castor* the frontal partly enclosed behind by the parietals. So that we have altogether in rodents quite a number of resemblances to characters found in *Polymastodon.* Most likely they are all due to convergence, though the suggestion has been made by Ameghino that the Rodents have sprung from the Multituberculates, and one would like to hesitate before denying the possibility.

In the following table I have given the principal Multituberculate characters, and the occurrence of similar characters in the Cynodontia, the Monotremata, the Marsupialia and Eutheria.

Multituberculate characters seen in other groups.

Multituberculata	Cynodontia	Monotremata	Marsupialia	Eutheria
1. Septo maxillaries (*Tritylodon*)	×	×	–	rarely (*Dasypus, Tatu*)
2. Large nasals	×	×	×	rarely (*Hystrix*)
3. Lacrymal large (*Tritylodon*)	×	–	×	most
L. small or lost (*Polymastodon*)	–	×	–	many rodents
4. Frontals small	×	×	–	–
5. Parietals overlapping frontals at side	–	×	–	–
6. Jugal small on upper side of arch (*Polymastodon*)	–	×	–	–
7. Maxilla meeting squamosal	–	×	–	some Insectivores
8. Perforated palate	–	–	×	some Insectivores
9. Palatine process of premaxilla	× (*Lycognathus*)	× (young)	×	×
10. Large vomer	×	×	×	most
11. Uncoiled cochlea	×	×	–	–
12. 3 incisors	rarely (*Lycognathus*)	–	Diprotodonts	most
13. 2nd incisor largest	–	–	–	rarely
14. Posterior molars multituberculate	–	×	–	rarely (convergence)
15. Single foramen for XIIth nerve	×	–	–	×
16. Mandible with small inflected border	–	some suggestion of inflection in *Ornithorhynchus*	marked inflected angle of diff. type	inflected angle in many rodents
17. Well developed coracoid	×	×	× (foetus)	–
18. Interclavicle (*Camptomus*)	×	×	–	–

When the known characters of Multituberculates are looked for in other groups it at once becomes manifest that the nearest affinity is with the Monotremes, and in a number of characters the agreement is so striking as to suggest that the affinity is pretty close. There is however one difficulty that arises in that *Polymastodon* comes much nearer to the Monotremes than does the very much more primitive *Tritylodon*. We might assume that the Monotremes and Multituberculates branched off independently from the Cynodont reptiles, and that all the resemblances are due to convergence; but against this is the extreme improbability of the articular and quadrate becoming converted into auditory ossicles of a similar type independently in two lines. But if we agree that the Multituberculates and Monotremes

had a common ancestor as late as Rhœtic times, when did the separation take place?

The structure of the zygomatic arch in *Polymastodon* is very remarkable. It is not primitive, for nothing exactly like it occurs in any of the Therapsida, and all known Cynodonts have well developed jugals. From what we see in rodents we may infer that the zygomatic process of the maxilla has become greatly developed in connection with the great specialisation of the posterior molars, and rodent-like movements of the jaws. But how is the similar structure of the arch in Monotremes to be explained? Presumably by their being descended from an ancestor which had a similar type of molars, and a rodent-like movement of the jaws. If this be so either the Monotremes have been descended from a primitive type perhaps allied to *Tritylodon* and by convergence acquired structures such as are seen in *Polymastodon,* or they may have sprung from a later type of Multituberculate.

Marsh has shown that in Cretaceous times there were many Multituberculates with teeth not unlike those of *Polymastodon* and not improbably in Middle Jurassic times there may have been Multituberculates which while retaining the large septomaxillaries of *Tritylodon* had by the adoption of some change of diet taken on a greater development of the posterior molars, and acquired a jugal arch like that of *Polymastodon,* with increase in size of the parietals and reduction of the lacrymals. From such an ancestor the living Monotremes may have sprung. I do not place any great weight on the pattern of the rudimentary molars of *Ornithorhynchus,* but it is certainly remarkable that in *Polymastodon* there are only two large molariform teeth, and even in the Plagiaulacids only the last two in the lower jaw are multituberculate, and that in *Ornithorhynchus* there are also only two large molars retained.

The conclusions which seem to me most probable are (1) that in Upper Triassic times the ancestral mammal arose from a generalised Cynodont; (2) that very early there branched off from the main line which gave rise to the Protodontia, the Trituberculata, the Triconodontia, and ultimately the Marsupials and Eutherians, a side branch of small herbivorous forms which losing their canines and taking on a peculiar specialisation of the incisors and molars started the line of the Multituberculates; (3) that the early Multituberculates were mainly herbivorous, the larger forms being root-eaters, and the smaller probably like mice practically omnivorous; (4) that later on some small types become mainly insectivorous and the lower premolars and 1st molar became specialised as cutting-teeth e. g. *Plioprion*; (5) that a further development along the same line resulted in the development of small carnivores such as *Plagiaulax* which probably

fed on lizards[1]; and (6) from a Middle Jurassic herbivorous Multituberculate there probably arose the line which after considerable specialisation and degeneration resulted in the Monotremes.

Note.— At the time of Dr. Broom's departure for Europe, when this article was in galley proof, I was engaged in the preparation of a specimen of a Plagiaulacid obtained from the Puerco formation of New Mexico last summer. The specimen consisted of the posterior portion of the skeleton and included two elements which appeared to be the two halves of the pelvis although at the time Dr. Broom last saw them they were not sufficiently removed from the matrix to be certain of their identification. Enough was exposed though to assure him that the bones were the same elements as those of the National Museum specimen, which he had figured as scapula and coracoid, whether they pertain to the shoulder or to the pelvic girdle. Further preparation has shown that these bones, without question, belong to the pelvis but to such an unusual pelvis that a misinterpretation based upon less complete and more poorly preserved material might readily be made. This note is inserted at Dr. Broom's request. A description of this new American Museum specimen will be published later.— Walter Granger.

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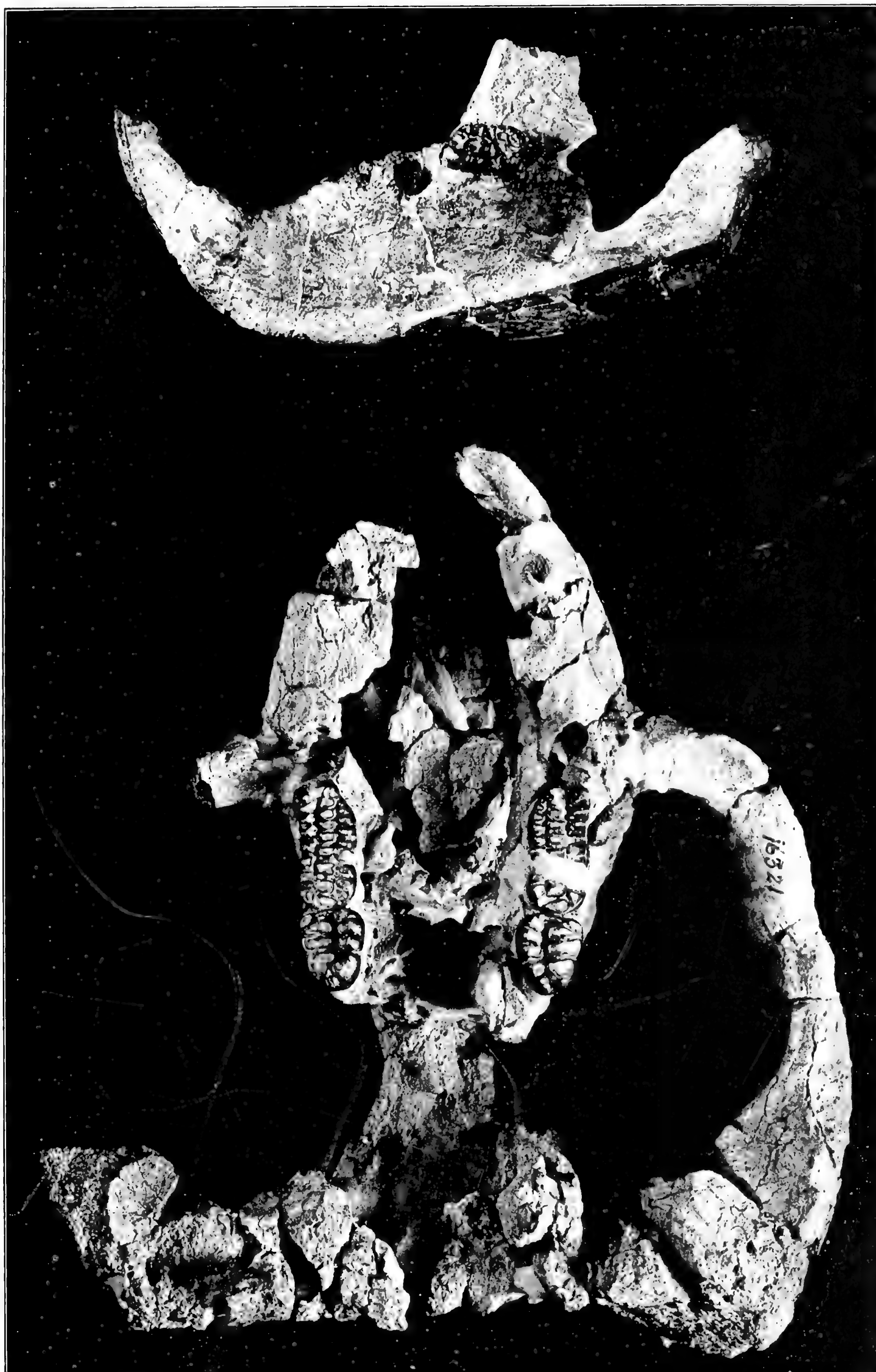
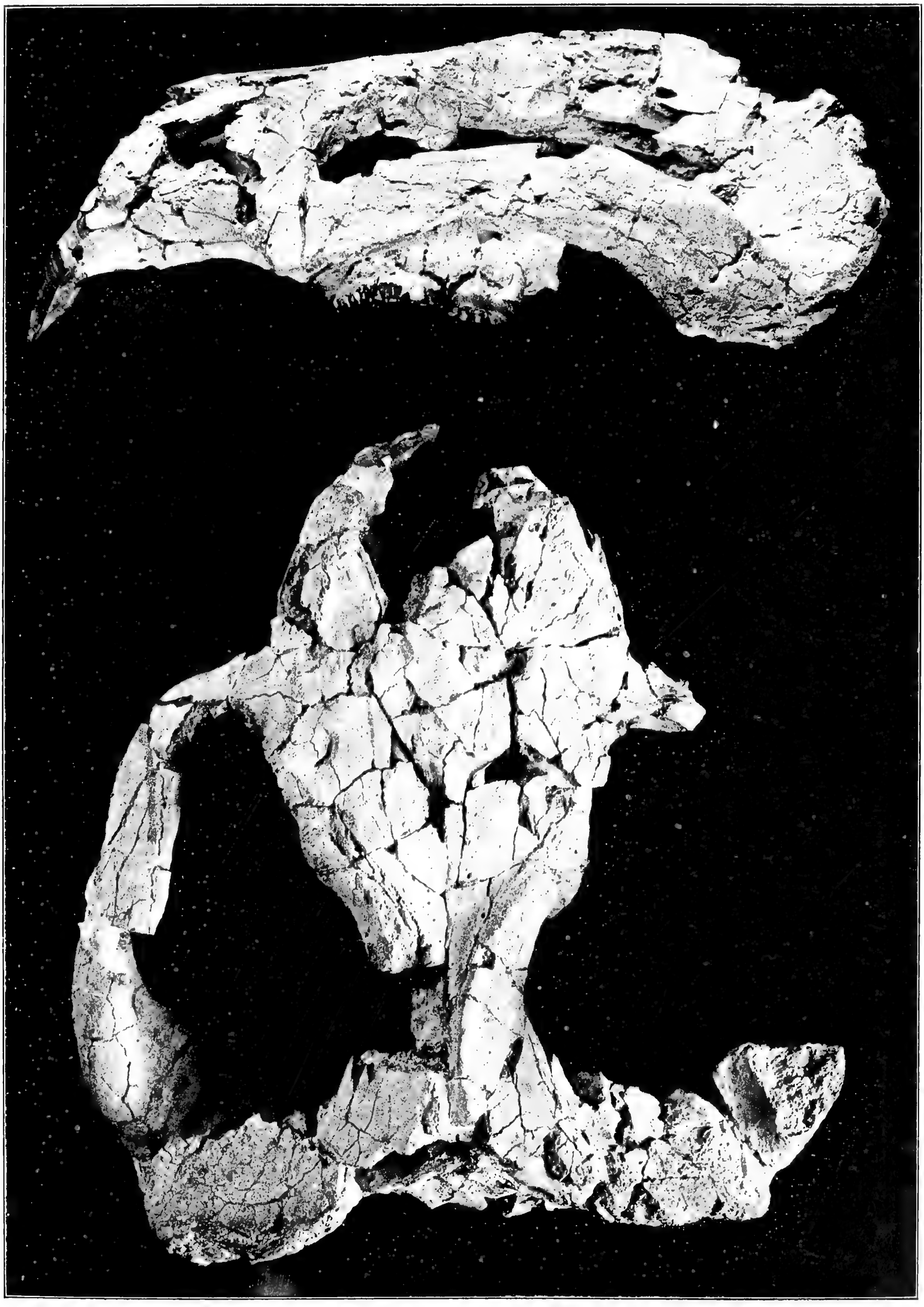
[1] When three years ago I suggested that *Plagiaulax* was a carnivorous modification of the Multituberculata specialised for killing and eating lizards I was not aware that Owen had made exactly the same suggestion though I knew that Owen regarded *Plagiaulax* as a carnivore.



Polymastodon taoensis *Cope.*
$\frac{2}{3}$ nat. size. Am. Mus. Nos. 748 and 16321.



Polymastodon taoensis *Cope.*

$\frac{2}{3}$ nat. size. Am. Mus. No. 16321.

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Article IX.— A FURTHER COMPARISON OF THE SOUTH AFRICAN DINOCEPHALIANS WITH THE AMERICAN PELYCOSAURS.

By R. Broom.

When in 1878 Cope first described an example of the American Pelycosaurs he regarded them as belonging to the Rhynchocephalia, but very shortly afterwards he recognized affinities with two other groups — the forms with a roofed temporal region which we now group under the name Cotylosauria, and the South African Permian reptiles placed by Owen in the orders Anomodontia and Theriodontia, and soon he came to regard the Theriodont affinity as stronger than the Rhynchocephalian.

From 1878 till now many different views have been expressed as to the affinities of the Pelycosaurs. For years most were inclined to agree with Cope in recognizing a close affinity with the South African mammal-like types. Then from 1897 onwards almost all palæontologists followed Baur and Case in believing that the affinities were more marked with the Rhynchocephalians.

In 1910 I endeavored to show that there was a distinct genetic relationship between the Pelycosaurs and the South African mammal-like reptiles, and especially with the Dinocephalians. Yet though all the additional evidence tends the further to strengthen this view it must not be thought that the earlier views of Cope, Baur, and Case, had no truth in them. The relationship of the Pelycosaurs with the Cotylosaurs is very manifest and there can be little doubt that the former is descended from the latter. With the Rhynchocephalians there are also many marked affinities. Both have doubtless had a common ancestry in the Cotylosaurs and though they have branched off in different directions they still each retain a good many common characters.

With the South African Dinocephalians the affinities are much more close as I hope to show, and while some of the points of agreement may be due to convergence others I feel convinced are due to a fairly close genetic relationship.

In my paper of 1910 on "A comparison of the Permian Reptiles of North America with those of South Africa" I showed that the bones of the skull of *Dimetrodon* so far as can be seen from the outside agree closely with those of the S. African Dinocephalian *Delphinognathus*. In the figure I gave the front of the *Delphinognathus* skull was restored from the nearly allied genus *Moschops*. The sutures shown are from the S. African Museum type speci-

men of *Delphinognathus conocephalus* where they can be clearly traced. Though one or two skulls of *Moschops* and other Dinocephalians, are known, no skull shows the sutures so clearly as the specimen which I have figured. Though the Dinocephalians were presumably planteaters and *Dimetrodon* a carnivorous type, and the skulls like every other part of the skeleton modified to suit very different habits the strikingly close agreement of the bones of the skulls as regards their relations to each other is remarkable.

The Dinocephalians have the bones of the top of the skull enormously thickened, yet all the bones around the orbit and the temporal fossa closely agree with those in *Dimetrodon.*

The structure of the occiput is not certainly known in any Dinocephalian. It is beautifully preserved in quite a number, but it is extremely

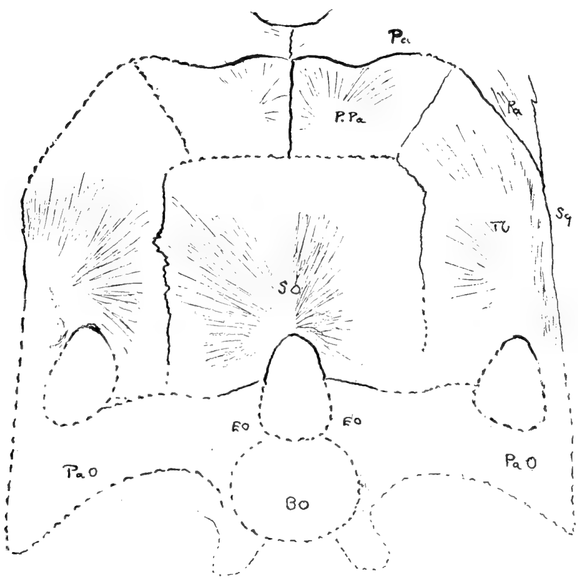

Fig. 1. Occiput of *Theropleura retroversa* Cope, slightly reduced. The parts shaded and the sutures in line are shown in the specimen.

difficult to trace all the sutures, though some can be made out clearly. There is certainly a transverse suture above which there appear to be a large interparietal or fused postparietals and a pair of tabulars. Between the transverse suture and the large foramen magnum there appears to be a supraoccipital. The exoccipitals are small, and the paroccipital very large. If the structure has been correctly interpreted it will be seen to agree closely with that of the Anomodonts and Cynodonts.

The occiput in the Pelycosaurs has never yet been very satisfactorily

made out. In 1909 I examined the best specimens of *Dimetrodon* in the Am. Mus. but as there were one or two points on which I felt doubt I did not publish my drawings. V. Huene has recently gone over the same specimens, and come to much the same conclusions as I did, namely that there is a pair of dermo-supra-occipitals or post parietals, a pair of tabulars, a median supraoccipital, small exoccipitals, and large opisthetics (paroccipitals). Fortunately I have come across in the collection of the American Museum a crushed but fairly good skull of apparently *Theropleura retroversa* Cope. While the occiput is somewhat crushed much of the structure can be made out without question. There are behind the parietals a pair of postparietals, with on each side a large tabulare. The tabulare articulates with the posterior process of the parietal and also with the squamosal. Below the pair of post parietals is a large median supraoccipital. Though the occipital condyle and exoccipitals are present in the specimen they are displaced and crushed, and have been restored in the drawing in dotted line. In some other Pelycosaurs e. g. *Edaphosaurus,* the postparietal is a single median bone, and the tabulars are narrow.

It will be seen that the occiput agrees essentially with the type found in the African types. It also agrees fairly closely with the type found in *Diadectes* which may be regarded as the primitive reptilian type.

The lower jaw has not hitherto been fully described in either the Dinocephalians or Pelycosaurs, though Case, v. Huene, and I have figured the outer side of the jaw of *Dimetrodon,* and Case has given drawings of the bones of the inner side in which an attempt is made to delimit the various bones. Prof. Williston has recently sent me a drawing of the jaw of *Dimetrodon* which is the most satisfactory of the inner side yet made, and in a note in "Science" 10th Oct., 1913, gives a brief description of it.

The structure of the Dinocephalian mandible though fairly well shown in the type of *Moschops capensis* Broom is shown in practically every detail in an allied form which may be called *Moschognathus whaitsi.*

On the outer side of the jaw the dentary forms about the interior $\frac{2}{3}$, the back third being formed by the articular, angular and surangular. On the inner side the dentary forms most of the symphysis and most of the upper half of the anterior third. There is no precoronoid bone present. The splenial forms the lower corner of the symphysis as indicated in the figure and occupies most of the lower half of the anterior portion of the jaw. It does not pass round to the outer side. The prearticular posteriorly lies underneath the articular and passes forwards forming the lower margin of the Meckelian fossa and passing between the splenial and the coronoid reaches the posterior part of the dentary. The coronoid is a fairly well developed bone which lies in front of the Meckelian fossa and passes forwards

some distance resting on the dentary. It is more flattened than usual, and though the jaw has a Meckelian fossa it is very narrow and differs considerably from the wide fossa seen in the Cotylosaurian jaw. The angular forms about the lower third of the posterior half of the jaw. At its posterior lower border the angular forms a thin fan-like expansion which

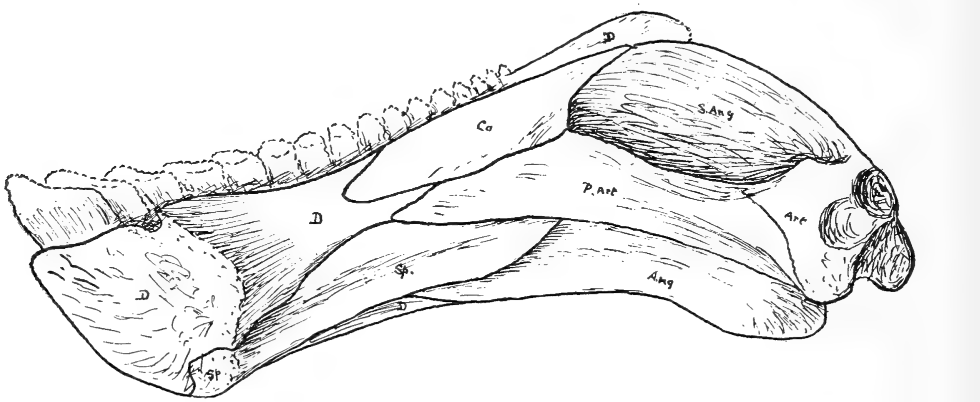

Fig. 2. Inner side of Mandible of *Moschognathus whaitsi* Broom. $\frac{2}{5}$ nat. size.

passing down from near the middle of the back part of the outer surface forms a deep narrow hollow such as is also seen in the Pelycosaurs and most Therapsids. The articular has two rounded articular pits which look backwards and a little inwards. There is a short postarticular process.

The structure of the outer side of the Pelycosaur jaw as has been known for some years is almost exactly similar to that of the Dinocephalian. The structure of the inner side has not hitherto been fully known.

The following description is based on the beautifully preserved jaw in the National Museum, Washington. It is there labelled *Dimetrodon cruciger*, but whether it is the jaw of a species of *Dimetrodon* or of *Naosaurus* or of some other Pelycosaur need not for the present concern us. It is certainly

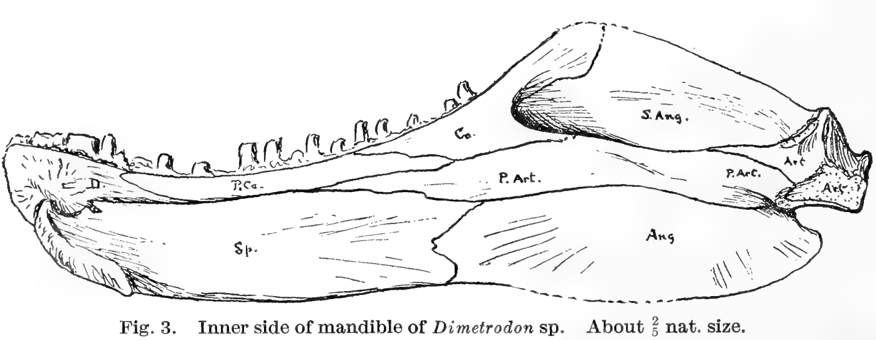

Fig. 3. Inner side of mandible of *Dimetrodon* sp. About $\frac{2}{5}$ nat. size.

the jaw of a near ally of *Dimetrodon* if not a species of that genus and certainly of a Pelycosaur. The inner side of the jaw shows the following bones: dentary, splenial, angular, prearticular, articular, surangular, coronoid,

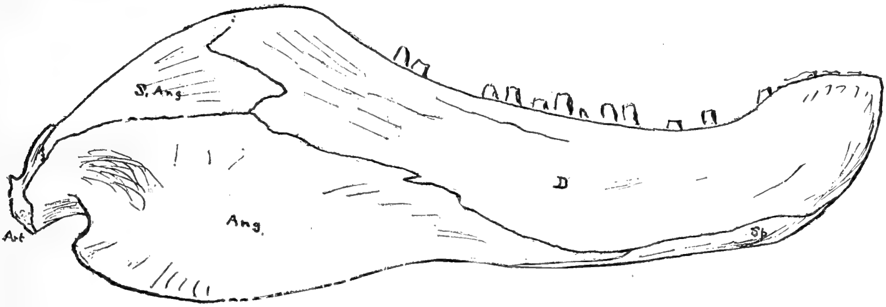

Fig. 4. Outer side of mandible of *Dimetrodon* sp. About $\frac{2}{5}$ nat. size.

and precoronoid. The dentary only shows at the symphysis and a little behind and to a slight extend along the alveolar border. The splenial forms most of the inner side of the anterior half of the jaw. Above it is a small supposed precoronoid bone. Williston has recently discovered this element in the *Dimetrodon* jaw but was not certain whether it is continuous with the coronoid. The coronoid is a fairly large element which forms the anterior border of the Meckelian fossa and has a firm articulation with the upper

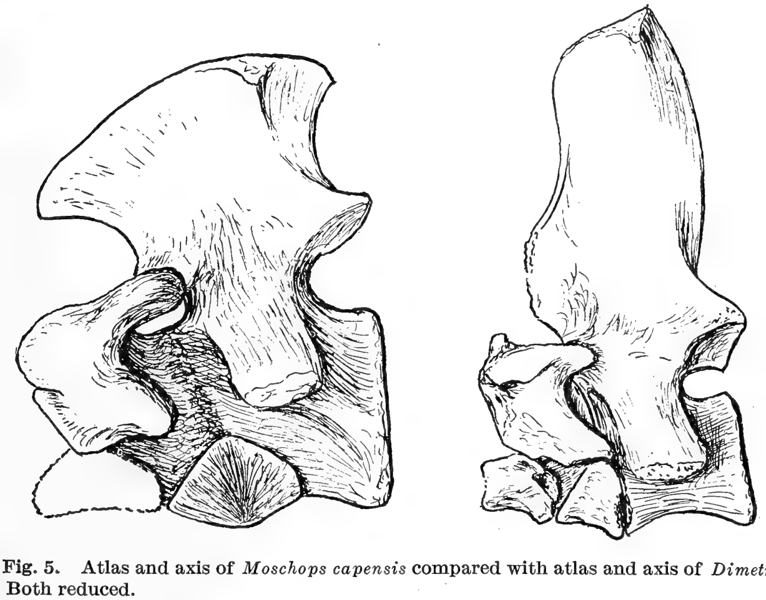

Fig. 5. Atlas and axis of *Moschops capensis* compared with atlas and axis of *Dimetrodon* sp. Both reduced.

part of the surangular. Below it has a long articulation with the prearticular. In front it has a long articulation with the precoronoid. Williston describes the coronoid in *Dimetrodon* as lying "at the summit of the coronoid eminence, extending about two inches back of the teeth. It is covered on the outer side by the dentary, and in inserted in a pit in the surangular... If it is continuous with the alveolar bone [my precoronoid], as it seems to be the connection must be very narrow." As will be seen in the drawing I give the condition in the Washington specimen is very different. The angular, surangular prearticular and articular will be readily understood from the figure given.

A comparison of the jaws of the Pelycosaur and the Dinocephalian shows that though the jaws are specialized as regards the dentition in quite different ways the essential structure is almost identical. The only difference of importance is the loss of the precoronoid bone in the Dinocephalian.

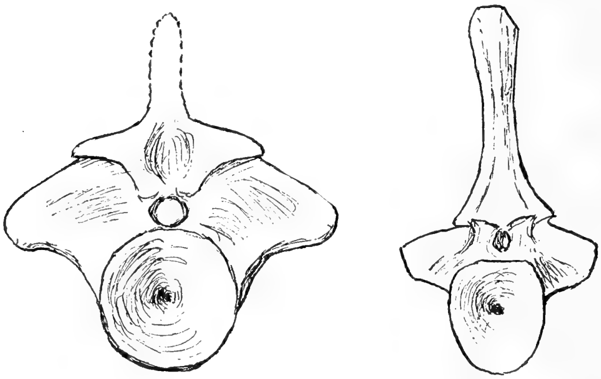

Fig. 6. Cervical vertebræ of *Moschops capensis* and of *Ophiacodon mirus*. The former original; the latter after Williston and Case. Both figures reduced.

In fact the Dinocephalian jaw might be regarded as a Pelycosaurian jaw in which the dentary had become much more powerfully developed in connection with the great specialization of the teeth.

The vertebræ of the Dinocephalian differ from those of the Pelycosaurs in being much more massive and in lacking the specialization of the spines, but in general structure the agreement is close.

A comparison of atlas and axis in the two groups will be seen in the figures given. Though doubtless many of the characters are common primitive features the striking similarity of the atlas, and the relations of the axis transverse process to the centrum seems to suggest affinity.

The cervical vertebræ are seen in Fig. 5 to be closely similar in the two groups.

The dorsal and later cervical vertebræ of the Pelycosaur are very re-

markable in the peculiar specialization of the transverse processes. Fig. 6 shows that the Dinocephalians have an exactly similar specialization.

The limbs in the Dinocephalians differ from those of the Pelycosaurs in being relatively much more massive. The Pelycosaurs were crawling animals with feeble limbs: the Dinocephalians heavy bodied walking animals, and the differences in the girdles and limbs are readily accounted for by the differences of habits.

Case objects to my comparison of the South African forms with the America, stating that "Broom's summary of evidence only cites as common

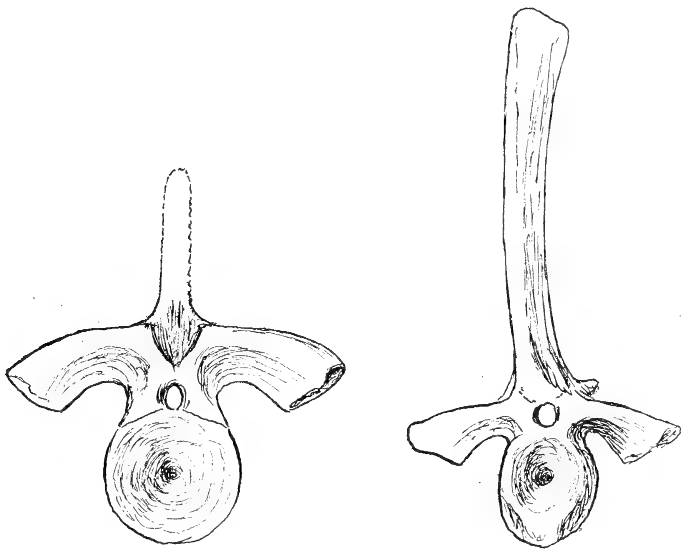

Fig. 7. Dorsal vertebra of *Moschops capensis* and posterior cervical vertebra of *Sphenacodon ferox.* The latter after Case and Williston.

characters the most primitive features, which all date from the time when the reptiles separated from the amphibians. Such a relationship of the two groups must be admitted, but it can only be very remote." The characters of the jaw, to take only a single point, seen in the two groups are not amphibian characters, and either we must assume that we have a marvellous case of convergence or a striking affinity. What seems to me the most remarkable thing about the Dinocephalian jaw is that notwithstanding the striking specialization of the front part the back half remains so typically Pelycosaurian as to be practically indistinguishable.

The later South African Therapsids have all taken on further specializations of the skull and jaw and though they can be readily compared with the Dinocephalian for the most part the Dinocephalian structure is nearer to the Pelycosaurian than to the Anomodont or Therocephalian.

59.7,58(729)

Article X.— *GOBIOSOMA LONGUM* AND *RIVULUS HEYEI*, NEW FISHES FROM THE WEST INDIAN FAUNA.

By John Treadwell Nichols.

Two small fishes, each the type of a previously undescribed species, have recently been added to the collections of the American Museum of Natural History.

Gobiosoma longum sp. nov.

The type and only specimen, No. 5068, American Museum of Natural History, was collected in the Florida Keys near Key West in the fall of 1913, by Lieut. Chapman Grant of the U. S. Army. It is 64 mm. long to base of caudal, depth 7 in this measure, head 5. Eye 4 in head, maxillary 2.3. The body is long and compressed,

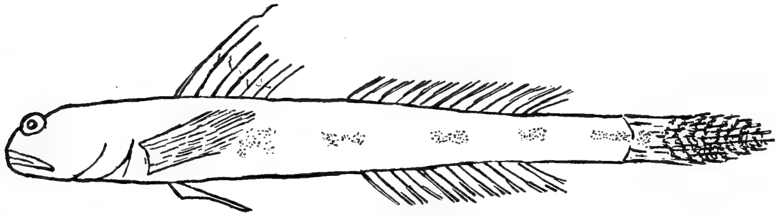

Fig. 1. *Globiosoma longum* sp. nov. Nat. size.

the head deep and narrow, the eyes anterior, dorsal, prominent, very close together. The maxillary extends to beyond the vertical from the posterior margin of the orbit. A row of conical, slightly bent teeth in the upper jaw, with smaller ones behind it. Lower jaw with a narrow band of teeth. The gill-opening, nearly vertical, is contained 2.5 in the head. The body is scaleless. Dorsal VII–14, Anal 13. The length of pectoral fin about equals head, united ventrals 1.4 in same. Caudal .8 in head, rather pointed, vertical fins moderate. Color in spirits pale, five more or less double horizontal dark marks along middle of sides, the last terminated by a dark spot on the base of the caudal. Caudal with dark cross-bars, except at base.

This specimen, a gift to the Museum from Lieut. Grant, is tentatively placed in the genus *Gobiosoma* on account of its lack of scales. In form and appearance it is quite dissimilar from others of that genus, and perhaps is more closely allied to some of the scaled forms.

Rivulus heyei sp. nov.

The type and only specimen, No. 5069, American Museum of Natural History, was collected on Saona Island at the eastern extremity of Haiti, by Mr. Theodoor de Booy. It is 20 mm. long to base of caudal. Head 3.6 in that length, depth 4.2.

Eye 3.0 in head, length of pectoral 1.3, of caudal 1.2. Dorsal with about 7 rays, anal with about 10. Scales about 40. Dorsal inserted a distance before caudal about equal to head behind center of eye. Its insertion about equidistant from tip of caudal and posterior margin of gill-cover. The insertion of the anal about equidistant from tip of caudal and tip of snout. Caudal strongly rounded. Color in spirits dark olivaceous, paler below. A dark lateral blotch placed just above and behind the base of the pectoral distinct on right side only. A rather large (about ½ the diameter of the eye) circular black spot, surrounded by a narrow pale ring, at the upper base of the caudal.

This specimen, a gift to the Museum from Mr. George G. Heye of New York, seems to be the first of the genus recorded from Haiti. Unfortunately it is too small for satisfactory study, but it is evidently distinct from closely related *Rivulus marmoratus* Poey from Cuba, of which we have several specimens for comparison,— one of about the same size. From these the type of *R. heyei* differs considerably in color. It lacks the pale marbling, the black center of the caudal ocellus is broader, the pale border narrower. Its pectoral is longer and the head, eye, and caudal probably slightly larger.

Named for Mr. Heye in recognition of his interest in furthering knowledge of Haiti.

59.9.32M.

Article XI.—REVIEW OF THE GENUS *MICROSCIURUS.*

By J. A. Allen.

The collection of tree squirrels in the American Museum of Natural History has been increased in the last few years by the addition of several hundred specimens from Colombia, Ecuador, and Peru. These added to previous collections in the Museum from Central and South America furnish a considerable basis for a preliminary survey of the tropical American Sciuridæ. They alone would, of course, be very inadequate for such an investigation. It was my privilege, however, to spend several weeks last year in a study of the South American squirrels in the British Museum, rich in types and other historic material, and to have with me a large selection of specimens from the American Museum for direct comparison with those in the British Museum.

In addition to these resources I have been able to borrow for examination much pertinent material from the United States National Museum, the Biological Survey, the Field Museum of Chicago, the Museum of Comparative Zoölogy at Cambridge, the Carnegie Museum of Pittsburgh, and the Academy of Natural Sciences of Philadelphia. To the authorities of these several institutions I tender my heartiest thanks for prompt and cordial responses to my requests for assistance, without which the present studies could not have been undertaken. I am especially indebted to Mr. Oldfield Thomas, curator of Mammals at the British Museum, for placing freely at my service the treasures under his charge, and for valued help in my work.

The present paper deals with the Pigmy Tree Squirrels (genus *Microsciurus*). It is my purpose to prepare, as rapidly as may prove practicable, similar reviews of other groups of the Central and South American Sciuridæ, this being the first of a proposed series.

Genus **Microsciurus** *Allen.*

Microsciurus (subgenus of *Sciurus*) Allen, Bull. Amer. Mus. Nat. Hist., VII, p. 332, Nov. 8, 1895. Type, *Sciurus* (*Microsciurus*) *alfari* sp. nov.

Microsciurus (subgenus) Nelson, Proc. Washington Acad. Sci., I, p. 32, pl. i, fig. 6, pl. ii, fig. 2, May 9, 1899. Type skull figured.

Microsciurus (genus) Goldman, Smithson. Misc. Coll., LVI, No. 36, p. 4, Feb. 12, 1912.— Miller, Bull. 79, U. S. Nat. Mus., p. 338, 1912.

Smallest of American tree squirrels; ears short, rounded, well-haired, sometimes

tufted, and sometimes with postauricular patches of whitish or buffy hairs. Tail short, usually narrow, about four fifths of the length of head and body. Mammæ 6.

Premolars $\frac{2}{1}$. Skull short and broad, with a very short, broad rostrum and high-arched braincase, the dorsal outline of the skull very convex; nasals very short, about one fourth of the total length of the skull, much less than the interorbital breadth; malar broad, vertically expanded; palate extending slightly beyond the last upper molars; upper molariform teeth nearly square, the length and breadth of the crowns about equal, implanted transversely to the axis of the toothrow; outer border of the crowns without median accessory cusps. Instead of the four cusps on the outer margin of the crown present in typical *Sciurus*, there are only two in *Microsciurus*.

The *Microsciuri*, or pigmy tree squirrels, form a closely circumscribed group, characterized externally by small size, short, narrow tails (about as in *Tamias* and *Eutamias*), and dull coloration, usually without distinctive patterns. These features, with a premolar formula of $\frac{2}{1}$, serve readily to distinguish them from their nearest allies, the guerlinguets (subgenus, or genus, *Guerlinguetus*), which always greatly exceed them in size, have a relatively much longer tail, a premolar formula of $\frac{1}{1}$, and a longer, narrower, and less convex skull.

The geographical range of *Microsciurus* is primarily the Andean region of South America, with an extension northward through Panama to Costa Rica, and eastward to the Guianas. The altitudinal range extends from sea-level to about 8000 feet. The range of none of the forms is as yet well-known, several of them being thus far represented in museums by only the type specimens. Doubtless other species remain to be discovered, since little is known of the distribution of the group in Brazil, Peru, or Ecuador. Almost nothing has thus far been recorded of their habits. Their scarcity in collections would seem to indicate that they are not easy to discover in the heavy tropical forests that constitute their haunts.

Following is a list of the species and subspecies, with their type localities and statement of the number of specimens of each examined in the preparation of the present paper.

Microsciurus alfari alfari Allen. Volcano Turrialba, near Jiménez, Costa Rica. Specimens examined, 6, including the type.

Microsciurus alfari venustulus Goldman. Gatun, Canal Zone, Panama. Specimens examined, 4, including the type and a topotype.

Microsciurus alfari browni Bangs. Bogaba, Chiriqui, Panama; altitude 600 feet. Specimens examined, 3, topotypes.

Microsciurus boquetensis Nelson. Boquete, Chiriqui, Panama; altitude 6000 feet. Specimens examined, 2, type and topotype.

Microsciurus similis similis Nelson. Cali, Western Andes, Colombia; altitude 6000 feet. Specimens examined, 12, including the type.

Microsciurus similis fusculus Thomas. Juntas, Rio San Juan, Chocó district, Colombia; altitude 400 feet. Specimens examined, 5, including the type and two topotypes.

Microsciurus pusillus (Desmarest). Cayenne. Specimens examined, none.

Microsciurus otinus Thomas. Medellin, Colombia. Specimens examined, 3, including the type and a topotype.

Microsciurus chrysuros (Pucheran). Santa Fé de Bogotá, Colombia. Specimens examined, none.

Microsciurus isthmius isthmius Nelson. Rio Truandó, Isthmus of Darien, Colombia. Specimens examined, 10, including the type and a topotype.

Microsciurus isthmius vivatus Goldman. Near Cana, eastern Panama; altitude 3500 feet. Specimens examined, 3, the type and 2 topotypes.

Microsciurus mimulus Thomas. Cachavi, Esmeraldas, Ecuador; altitude 560 feet. Specimens examined, 14, including the type and 2 topotypes.

Microsciurus palmeri Thomas. Sipi, Chocó district, Colombia; altitude 150 feet. Specimens examined, 12, including the type and 7 paratypes (one of them a topotype).

Microsciurus simonsi Thomas, Porvenir, Bolivar Province, Ecuador; altitude 5000 feet. Specimens examined, 1, the type.

Microsciurus peruanus Allen. Guayabamba, Peru; altitude 4000 feet. Specimens examined, 1, the type.

Microsciurus napi Thomas. Mouth of Rio Coco, upper Rio Napo, Ecuador. Specimens examined, 1, the type.

Microsciurus kuhlii (Gray). "Brazil (Castelnau)." Specimens examined, none.

Microsciurus brevirostris sp. nov. Chanchamayo, central Peru; altitude 5000–5300 feet. Specimens examined, 5, including the type.

Microsciurus florenciæ sp. nov. Florencia, Caquetá district, Colombia; altitude 1000 feet. Specimens examined, 4, including the type.

Of the 19 species and subspecies here recognized (15 species and 4 additional subspecies), the types of 15 of them and topotypes of another (*browni*) have been examined; of the other three forms (*pusillus, chrysuros, kuhlii*) no specimens have been seen. Three other species are thus far known only from the type specimens, while four are represented by from 10 to 12 specimens each. The total number of specimens examined in the present connection is 86; they include all (except the type of *browni*) known to exist in American museums and in the British Museum, as follows: British Museum, 36; American Museum of Natural History, 30; U. S. National Museum, 7; Biological Survey collection, 10; Museum of Comparative Zoölogy, 3.

The uniformity in size and proportions, so far as shown by the available measurements (see table of measurements on p. 165), throughout the group is striking, the range of individual variation in any considerable series of specimens exceeding the average difference between the smallest and largest species and subspecies in both external and cranial measurements. *Microsciurus palmeri, M. rubrirostris,* and *M. florenciæ* average slightly larger than most of the others and have a relatively longer tail; of many of the forms, however, the number of available specimens (from 1, or even none in several cases, to 3 or 4) is too few to establish standards of size.

M. mimulus and *M. palmeri* are the only forms that can be said to have a distinct color pattern (aside from the white or buff markings on the ears of some of the species), *mimulus* having a black dorsal band and *palmeri* a black crown, traces of which latter also occur in *isthmius*. In general the upperparts are dark brown suffused with yellowish, rufous, olivaceous, or grayish tones, due to narrow annulations of these tints at the tips of the hairs, which are otherwise dark brown. The ventral surface varies from gray or dull brown, slightly washed with pale yellowish in some of the forms, to deep ochraceous or rufous in others, so deep as almost or wholly to conceal the dark basal portion of the hairs.

In *M. otinus* the ears are tipped with white; in *M. peruanus, M. napi, M. florenciæ*, and *M. kuhlii* the backs of the ears are white and there are large postauricular white patches. *M. rubrirostris* has a similar patch of buff. In *M. alfari venustulus* two out of four of the known specimens have an inconspicuous buffy spot at the base of the ears. In all the other forms special ear-markings are absent.

The small premolar (p^3) is rarely absent, being often a functional tooth with an enlarged crown.

The length of the tail vertebræ in all but three of the species is 80% of the length of the head and body; in the other three (*M. palmeri, M. rubrirostris, M. florenciæ*), 94 %.

Key to the Species and Subspecies.

a. No white or buff spot on ears; no postauricular buff or white patches.
  b. Annulations at tips of hairs on upperparts narrow.
    c. Above yellowish rufescent; head clearer rufous; eyerings orange; below washed with fulvous. (Central Costa Rica.)
      Microsciurus alfari alfari (p. 149)
    cc. Paler throughout, especially on the head; below soiled whitish with a fulvous wash. (Canal Zone, Panama).
      Microsciurus alfari browni (p. 151)
    d. Above similar to *M. a. alfari* but paler; eyerings obsolete; below orange rufous. (Western and Central Andes, Colombia.)
      Microsciurus similis similis (p. 153)
    dd. Similar to *M. s. similis* but darker and slightly smaller. (Coast region, Chocó district, Colombia.)
      Microsciurus similis fusculus (p. 154)
    e. Above similar to *M. a. alfari* but paler; pelage longer and fuller; below ochraceous rufous. (Chiriqui, Panama.)
      Microsciurus boquetensis (p. 151)
    ee. Above darker, with yellow eyerings; below fulvous. (Bolivar Province, Ecuador.)......................**Microsciurus simonsi** (p. 161)

bb. Annulations at tips of hairs on upperparts broad.

c. Yellowish annulations at tips of hairs very broad; ventral surface fulvous; a blackish dorsal stripe. (Coast region of northwestern Ecuador and southwestern Colombia.)
Microsciurus mimulus (p. 158)

cc. Above more rufescent; ventral surface deep rufous; crown black; no dorsal stripe. (Chocó district, Colombia.)
Microsciurus palmeri (p. 160)

d. Above darker, fulvous rings at tips of hairs rather narrower; below deep rufous; no crown patch nor dorsal stripe. (Coast-region of northwestern Colombia.)
Microsciurus isthmius isthmius (p. 157)

dd. Above paler and more olivaceous; ventral surface much paler, orange buff instead of deep rufous. (Pirri Mountains, Panama.)
Microsciurus isthmius vivatus (p. 158)

aa. Ears tipped with white, or with white or buff postauricular patches.

b. Ears tipped with white; no postauricular patches; tail edged with whitish. (Medellin, Colombia.)................**Microsciurus otinus** (p. 156)

bb. Ears not tipped with white; inconspicuous postauricular patches of whitish or buff.

c. Postauricular patches small, whitish (Cayenne, British Guiana).
Microsciurus pusillus [1] (p. 154)

cc. Postauricular patches small, buffy, inconstant. (Canal Zone, Panama.
Microsciurus alfari venustulus (p. 150)

d. Postauricular patches large, conspicuous, white or buff.

e. Size large, tail long.

f. Above yellowish rufous; below orange ochraceous; back of ears and postauricular patches buff; tail edged with yellowish. (Chanchamayo, central Peru.)
Microsciurus rubrirostris (p. 163)

ff. Above darker and less rufescent; below whitish gray; tail edged with white. (Caquetá district, Colombia.)
Microsciurus florenciæ (p. 164)

ee. Size smaller, tail shorter.

g. Above dusky olivaceous; below yellowish rufous; large white postauricular patches; tail edged with whitish. (Northwestern Peru.)...................**Microsciurus peruanus** (p. 161)

gg. Above rusty fulvous; ventral surface pale fulvous; tail edged with fulvous. (Upper Rio Napo.).**Microsciurus napi** (p. 163)

Microsciurus chrysuros and *M. kuhlii* are too imperfectly known to be included in the key.

Microsciurus alfari alfari *Allen.*

Sciurus (*Microsciurus*) *alfari* Allen, Bull. Amer. Mus. Nat. Hist., VII, p. 333, Nov. 8, 1895.

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[1] If *M. pusillus* proves not to have white postauricular patches (see below, p. 155) it should stand in this key near the *M. similis* group, from which it differs in paler and yellower coloration.

Sciurus alfari Nelson, Proc. Washington Acad. Sci., I, p. 105, pl. i, fig. 6, pl. ii, fig. 2, May 9, 1899. Type skull figured.
Microsciurus alfari Miller, Bull. 79, U. S. Nat. Mus., p. 338, 1912.

Type locality.— Volcan de Turrialba, near Jiménez, Costa Rica.

Geographic distribution.— Known only from central Costa Rica.

Description.— Prevailing color of upperparts yellowish rufescent; head rufous, deepest on the front and sides; distinct eyering orange; underparts washed with fulvous; ears small, rounded, clothed with short hairs, uniform in color with the surrounding pelage; tail hairs ringed black and rufous, tipped with yellowish.

Total length (type from dry skin), 250; head and body, 145; tail vertebræ, 105; hind foot (with claws), 36.5 (without claws, 34). Skull, occipitonasal length, 36; zygomatic breadth, 22; breadth of braincase, 19; interorbital breadth, 13; length of nasals, 10.

Specimens examined, 6:— Costa Rica: Jiménez, 3, type and two topotypes (one of the latter is not now available, Am. Mus.); Pucado de Teraba, 1; Carillo (altitude 1000 ft.), 2 (Brit. Mus.). Two of the British Museum specimens are labelled "*Sciurus chrysurus* Puch.," probably before *M. alfari* was recognized.

Remarks.— *M. alfari alfari* resembles *M. similis* in the coloration of the upperparts, but the ventral surface is much paler, fulvous instead of rufous, and the general size is apparently less. It differs from the *M. isthmius* group in the rufescent instead of yellowish tone of the upperparts, and in the paler color of the ventral surface.

Microsciurus alfari venustulus *Goldman.*

Microsciurus alfari venustulus Goldman, Smithson. Misc. Coll., LVI, No. 36, p. 4, Feb. 19, 1912.— Miller, Bull. 79, U. S. Nat. Mus., p. 338, 1912.

Type locality.— Gatun, Canal Zone, Panama.

Geographic distribution.— Known only from the Canal Zone, Panama.

Description.— Similar to *M. alfari alfari,* from which it differs in paler coloration, being less rufescent above and less strongly washed below with fulvous. It has also a partly concealed yellowish white postauricular patch in two out of the four known specimens, a feature evidently subject to individual variation.

Total length (type, collector's measurements), 250; head and body, 148; tail vertebræ, 102; hind foot, 40. Skull, occipitonasal length, 37; zygomatic breadth, 23.2 breadth of braincase, 17.6; interorbital breadth, 14; length of nasals, 10.5.

Specimens examined, 4.— Panama: Gatun, 2 (type and a topotype); Cana, 1; Porto Bello, 1 (Biol. Surv.).

Remarks.— *M. a. venustulus* is closely related to *M. a. alfari*, but seems entitled to recognition as a subspecies of the *alfari* group. The Cana specimen has the ventral surface as strongly washed with yellowish rufous as any of the known specimens of *alfari*, but the others are paler both above and below. The fulvous postauricular patch is present in the type, an adult female, and in the Porto Bello specimen, but absent in the immature female topotype and in the adult male from Cana. Its presence or absence is therefore not correlated with either sex or age. The type lacks the small premolar, present in the other three specimens.

Microsciurus alfari browni *Bangs.*

Sciurus (*Microsciurus*) *browni* Bangs, Bull. Mus. Comp. Zoöl., XXXIX, p. 24, April, 1902.

Microsciurus browni Miller, Bull. 79, U. S. Nat. Mus., p. 338, 1912.

Type locality.— Bogabo, Chiriqui, Panama; altitude 600 feet.

Geographic distribution.— Known only from the type locality.

Description.— Texture of pelage and coloration of upperparts nearly as in *M. a. alfari*, but coloration paler, especially on the front and sides of the head (including eyerings) and sides of the neck; underparts much paler — soiled whitish with a slight buffy wash, most pronounced on the chest.

Total length (type, collector's measurements), 260; head and body, 140; tail vertebræ, 120; hind foot, 38. Skull, occipitonasal length, 36; zygomatic breadth, 21.2; interorbital breadth, 12.4; length of nasals, 11.

Specimens examined.— Three topotypes (Mus. Comp. Zoöl.).

Remarks.— Agrees with *M. a. venustulus* in size and in the coloration of the upperparts, but has the ventral surface much paler. It is obviously a lowland form of the *alfari* group, with no very close relationship to the *isthmius* group.

Microsciurus boquetensis *Nelson.*

Sciurus (*Microsciurus*) *boquetensis* Nelson, Proc. Biol. Soc. Washington, XVI, p. 121, Sept. 30, 1903.

Microsciurus boquetensis Miller, Bull. 79, U. S. Nat. Mus., p. 338, 1912.

? *Sciurus rufoniger* Alston, Proc. Zool. Soc. London, 1878, p. 669. Veragua, Panama. Not *S. rufoniger* Gray, 1842, nor of Allen, 1877.

Type locality.— Boquete, Chiriqui, Panama; altitude 6000 feet.

Geographic distribution.— Known only from the type locality.

Description.— Pelage full, soft and fine; color of upperparts nearly as in *M. a. alfari;* underparts heavily washed with ochraceous rufous, nearly as in *M. isthmius.*

Total length (type, collector's measurements), 257 (topotype, 268); head and body, 141 (topotype, 166); tail vertebræ, 116 (topotype, 102); hind foot, 37 (topotype, 26 = 36?). Skull (type, imperfect), occipitonasal length, ?; palatal length, 15.5; zygomatic breadth, ?; breadth of braincase, ?; interorbital breadth, 14; length of nasals, ?; upper molar series, 7.

Specimens examined.— The type (Brit. Mus.), and a topotype (U. S. Nat. Mus.).

Remarks.— A strongly differentiated mountain form of the *alfari* group, with the soft fine pelage and strongly colored ventral surface of the *similis* group, in correlation with the altitude of its haunts. It seems entitled to rank as a species until its intergradation with other forms has been shown.

Reference is necessary in this connection to *Sciurus rufoniger* Pucheran (*l. c.*), described in 1845 from a specimen supposed to have come from Santa Fé de Bogotá, Colombia, under a preoccupied name (not *Sciurus rufoniger* Gray, 1842). I used the name erroneously in 1877 (Mon. N. Amer. Roden., pp. 757, 758) for *Sciurus hoffmanni,* and Alston in 1878 (P. Z. S., 1878, p. 669) employed it for specimens of *Microsciurus* from Panama. Alston says: "On examining the type of Pucheran's *S. rufo-niger* in the Paris Museum, ... I soon recognized in it a small Squirrel of which I had seen several specimens from Panama, and which I began to fear would require a new name. These examples prove to agree further with *S. deppei* in having two upper premolars, but differ in being more than one third smaller, in the colour of the lower parts (which are only paler than the upper, save on the breast), and in the tail being nearly uniform in colour with the back (the hairs having only very minute white or yellow tips). Specimens in the British Museum are labelled *M. tephrogaster minor* [Gray, MS.]; but I cannot doubt the distinctness of the form. The type of *S. rufoniger* has the middle of the back nearly black; while that of *M. chrysosurus* [*sic*] appears to be a variety, merely differing in the tail being more rufous."

The locality of Alston's specimens is given as Veragua, Panama, and they are doubtless referable to some form of *Microsciurus.* His description of *S. rufoniger,* based on these specimens, is as follows: "Average length about 5.50 inches; of tail vertebræ 3.75 inches. Two upper premolars. Upper parts dark olive, the hairs very minutely tipped with fulvous; breast bright rufous, rest of lower parts like the upper, but paler; tail nearly uniform with the back, the hairs reddish fulvous, barred with black and minutely tipped with pale yellow."

Alston's description of his *S. rufoniger,* his accompanying comment, and the locality agree closely with *M. boquetensis,* but the name, though much earlier than *boquetensis,* is of course untenable in this connection.

The *S. rufoniger* of Pucheran is quite a different question. According to Alston the type specimen has two premolars, and is similar in size to his Veragua specimens of *S. rufoniger.* The original description says: "Taille du Guerlinguet [= *Sciurus æstuans*]," and it is thus larger than *S. chrysuros,* which is "intermédiaire par sa taille entre le Guerlinguet et l'Ecureuil nain [*Microsciurus pusillus*]." That it is not the same as his *S. chrysuros,* described on the following page, is evident, as it has a well-marked black dorsal line from between the shoulders to the base of the tail, and the underparts are yellowish gray, with the breast yellow and tail hairs tipped with white. The presence of a black dorsal band is confirmed by Alston, who says the type of *S. rufoniger* "has the middle of the back nearly black." The coloration thus points to a form like *M. mimulus,* which it cannot be if the source of the specimen is rightly stated. There may be such a form in the Bogotá region, but its occurrence there remains to be confirmed. The presence of two upper premolars excludes it from *Guerlinguetus.*

Microsciurus similis similis *Nelson.*

Sciurus (*Microsciurus*) *similis* Nelson, Bull. Amer. Mus. Nat. Hist., XII, p. 78, April 14, 1899.— Allen, *ibid.*, XXXI, p. 92, April 19, 1912.

Type locality.— Near Cali, Western Andes, Colombia; altitude 6000 feet.

Geographic distribution.— Colombia: Western and Central Andes at altitudes of 4000 to 7200 feet.

Description.— General color above yellowish rufescent, nearly as in *M. alfari alfari;* underparts orange rufous; no distinct eyerings nor earmarkings.

Total length (5 adults, Western Andes, collector's measurements), 250 (240–265); head and body, 127 (124–132); tail vertebræ, 121 (110–133); hind foot (without claws), 33 (30–35).

Skull (4 adults), occipitonasal length, 35.4 (35–36); zygomatic breadth, 20.5 (20–21); interorbital breadth, 13.1 (13–13.5); breadth of braincase, 17.7 (17–18.5); length of nasals, 10.2 (10–11).

Specimens examined, 12.— Colombia: Western Andes (Cali, 1, type); San Antonio, 1; Cocal, 2; Gallera, 2; Central Andes (Salencio, 2), all Am. Mus; near Cali, 4, Brit. Mus.

Remarks.— *M. similis similis* closely resembles *M. a. alfari* in general features, from which it differs in smaller ears, absence of bright-colored eyerings and of the strong rufous coloration of the head, and the more pro-

nounced orange rufous of the ventral surface. The two forms are also rather widely separated geographically.

This is one of the few species represented in the present material by a fairly large series of specimens. The 12 specimens examined present a rather restricted range of individual variation, varying chiefly in tone of coloration, which is more rufescent in some specimens than in others, both above and below. The type proves to be rather redder than the average of the series. The pelage is full, short, and soft, as compared with that of the *mimulus* and *isthmius* groups, and much more rufescent above.

Microsciurus similis fusculus *Thomas.*

Sciurus (Microsciurus) similis fusculus Thomas, Ann. and Mag. Nat. Hist. (8), VI, p. 503, Nov. 1910.

?Microsciurus similis fusculus Lönnberg, Arkiv. för Zool., VIII, No. 16, p. 26, July 12, 1913. Near Gualea, Ecuador.

Type locality.— Juntas, Rio San Juan, Chocó district, Colombia; altitude 400 feet.

Geographic distribution.— Known only from the Chocó district, Colombia.

Description.— Like *M. s. similis,* but somewhat smaller, coloration darker and less olivaceous.

Total length (type, collector's measurements), 234; head and body, 126; tail vertebræ, 108; hind foot (without claws), 33.

Skull (no measurements available).

Specimens examined, 5.— Colombia: Juntas, Chocó district, type and topotype (Br. Mus.); Juntas, 1, topotype; Baudo (near Juntas), 2. (Am. Mus.).

Remarks.— A slightly differentiated coast form of *similis.* One of the Baudo specimens lacks the minute first premolar (p^3) on both sides.

Lönnberg (*l. c.*) has recorded specimens from near Gualea (altitude 3000 feet), Ecuador, but it seems unlikely that they can represent this form.

Microsciurus pusillus (*Desmarest*).

Le petit guerlinguet Buffon, Hist. nat., Suppl., VII, p. 263, pl. lxvi, 1789. Cayenne.

Sc[iurus] pusillus Desmarest (ex Geoffroy MS.), Nouv. Dict. d'Hist. nat. (nouv. éd.), X, p. 109, 1817. Based on Buffon, as above.

Macroxus pusillus Gray, Ann. and Mag. Nat. Hist. (3), XX, p. 433, Dec. 1867. Guiana.

Sciurus pusillus Alston, Proc. Zool. Soc. London, 1878, p. 670, pl. xli (part).— Allen, Bull. U. S. Geol. Survey (Hayden), IV, No. 4, pp. 887, 905, Dec. 11, 1878 (part).

Type locality.— Cayenne.

Geographic distribution.— Cayenne (Buffon); Guiana (Gray).

Description.— "Fur soft, dark olive, yellow-grey-washed; head redder; hairs blackish from the base, with yellow-grey tips; cheeks, chin, throat, chest, and belly yellowish grey; hairs dark lead-coloured, with yellow-grey tips; ear-tufts none or very small; tail slender, cylindrical, black slightly varied with yellow; the hairs of the base yellow, with a basal and subterminal black band and a yellow tip, those of the tip black, with a yellowish base.

"A very small species: body and head $4\frac{1}{2}$ inches long. The front of the shoulders and thighs yellower than the rest of the body.

"*Hab.* Tropical America: B. M. Cayenne (Buffon)." — Gray, *l. c.*

Alston (*l. c.*) figures the species as having small white postauricular patches but does not mention them in his description. In his remarks on *M. kulhii* he says: "The type of *M. kuhlii* .... merely differs [from *pusillus*] in having a white spot at the root of each ear, and in the extreme tips of the hairs of the tail being white instead of fulvous," implying the absence of both these features in his specimens of *M. pusillus.* It may be that the white patches were added on the basis of the *kuhlii* specimen.

Skull (no measurements available).

Specimens examined.— None.

Remarks.— *M. pusillus* was the first recorded species of the genus, having been described and figured by Buffon in 1798, under the name *le petit guerlinguet,* from a specimen sent from Guiana by Sonnini de Manoncour. His description is based on an old male "quatre pouces trois lignes depuis l'extremetié du nez jusqu'a à l'origine de la queue, qui n'ayant que trois pouces trois lignes de long." This specimen appears to have been named in manuscript (doubtless on a museum label) by Geoffroy, which name was first published by Desmarest in 1817, with a redescription of the specimen.

It was afterward redescribed by Gray (1867) and again described and figured by Alston (1878) from specimens from Guiana in the British Museum,[1] the latter stating that the species had "two upper premolars." He synonymized with it *Macroxus kuhlii* Gray, which is, however, a very different species, having the tail edged with white and a white spot at the base of the ears. No postauricular patches are indicated in Buffon's figure (*l. c.*) of *pusillus,* nor mentioned in his detailed description of the species, where the ears are described as follows: "les oreilles sont garnies de poils fauves en dedans, au lieu que celles du grand guerlinguet sont nues."

This species appears to be not represented in any American Museum. Nothing apparently is known of its distribution outside of the Guianas.

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[1] I must have seen these specimens, but I find no mention of them in my notes, as I had not then planned to review the group as a whole.

Microsciurus otinus *Thomas.*

Sciurus (*Microsciurus*) *otinus* Thomas, Ann. and Mag. Nat. Hist. (7), VII, p. 193, Feb. 1901.

Type locality.— Medellin, Colombia.

Geographic distribution.— Recorded only from Medellin and Valdivia, at altitudes of about 3000 to 4000 feet.

Description.— Upperparts pale gray with the hair-tips pale fulvous; underparts washed with pale chestnut rufous, strongest over the pectoral region; orbital ring obsolete; ears externally tipped with white, not tufted, and no basal auricular patch; tail sparsely fringed with whitish; upper surface of feet grayish punctated with pale fulvous.

Total length (type), 242; head and body, 130; tail vertebræ, 112; hind foot, with claws, 36 (without claws, 33). Skull, tip of nasals to front of interparietal, 33.3; zygomatic breadth, 22.7; interorbital breadth, 13.3; length of nasals, 10.

Specimens examined, 3.— Colombia: Medellin, 2, type and a topotype; Valdivia, 1 (Brit. Mus.).

Remarks.— Similar in general coloration to *M. isthmius* Nelson but paler both above and below, with white-tipped ears and a whitish tail-fringe. There are no flesh measurements, but the skins and skulls indicate no diagnostic difference in size from its congeners. The peculiar marking of the ears distinguishes it sharply from its nearest geographical allies, as does also its white-edged tail.

Microsciurus chrysuros (*Pucheran*).

Sciurus chrysuros Pucheran, Rev. Zool., 1845, p. 337.

Sciurus (*Microsciurus*) *chrysuros* Allen, Bull. Amer. Mus. Nat. Hist., IX, p. 116 (footnote), April 26, 1897.

Type locality.— Santa Fé de Bogotá, Colombia.

Geographic distribution.— Known only from the type locality.

Description.— "Dos, tete, flancs, membre présentant la teinte générale des Guerlinguet, mais plus foncée; queue ronde, offrant à sa base la coloration du dessus du corps, roux doré dans le reste de son étendue. La gorge est jaunâtre, le reste des parties antérieures offre, mais d'une manière très-effacée, la couleur de la queue. Dans cette espèce, intermédiaire par sa taille entre le Guerlinguet et l'Écureuil nain [*Microsciurus pusillus*], les oreilles sont si petites, qu'elles ne s'élévent que de quelques lignes au-dessus du poil du reste de la tête.

"Habite la Colombie (Santa-Fé de Bogotá)." — Pucheran, *l. c.*

No measurements available.

Specimens examined.— None.

Remarks.— The description of this species is too vague to satisfactorily define it, as neither coloration nor size is very explicitly indicated, and the number of premolars is not stated. Thomas (Ann. and Mag. Nat. Hist. (7), VII, p. 194, Feb. 1901) refers to it as allied to his *M. otinus,* from which it "may be distinguished by its golden or ferruginous tail." I have seen no specimens of *Microsciurus* from the Bogotá region, the alleged type locality.

Microsciurus isthmius isthmius *Nelson.*

Sciurus (*Microsciurus*) *isthmius* Nelson, Bull. Amer. Mus. Nat. Hist., XII, p. 77, April 14, 1899.

Type locality.— Truandó River, Isthmus of Darien, Colombia.

Geographic distribution.— Coast region of Colombia from the Truandó River south to the Rio San Juan, Chocó district.

"Entire upperparts, including feet, uniform grizzled dark yellowish brown; ears yellowish brown, much paler than crown; sides of nose and chin dingy brown with suffusion of dull rufous; under side of neck and breast dingy ferruginous, shading posteriorly into dark reddish brown lightly washed with rufous; tail above grizzled rusty brown and black, hairs indistinctly tipped with pale yellowish; tail below similar but median area more rusty rufous; hairs on back black with broad subterminal rings of yellowish brown.

"Measurements of type, from dried skin. Length of [head and] body, 150; tail, imperfect; hind foot, 37." — Nelson, *l. c.*

Three specimens from the Chocó district (Noanama, 1, Juntas de Tamaná, 2), total length, 243 (230–250); head and body, 137 (120–140); tail vertebræ, 110 (110–110); hind foot, 36 (35–38).

Skull (type, imperfect), total length, ?; zygomatic breadth, 23; breadth of braincase, 15; interorbital breadth, 13; length of nasals, 10.5. Three skulls from Baudo, occipitonasal length, 35.3 (33–38); zygomatic breadth, 21.9 (21–22.8); interorbital breadth, 13.3 (13–14); breadth of braincase, 17.8 (17–19); length of nasals, 10.2 (10–10.5). The largest of the three is a female, the others males. One of the males lacks the small premolar.

Specimens examined, 10.— Colombia: Rio Truandó, the type and a topotype (Nat. Mus.); Baudo, 3; Bagado, 1; Juntas de Tamaná, 2; Noanama, 1; Nóvita, 1 (Am. Mus.).

Remarks.— *M. isthmius* was described from two specimens, both with imperfect skins and skulls. It was compared by the describer with *M. alfari,* but it is more nearly related to the *M. mimulus* group, particularly to *M. palmeri.* I refer to it 8 specimens from the Chocó district, about

150 miles south of the Rio Truandó, where *M. isthmius* occurs with *M. palmeri* and *M. similis fusculus*.

M. isthmius is decidedly smaller than *palmeri* (hind foot about 4 mm. shorter, skull about 2 mm. shorter, and narrower), and much less rufescent. Two of these specimens have (like the type and topotype) a slight intermixture of black hairs in the crown, suggestive of the black cap of *palmeri*. As both forms occur together in the Chocó district, they are here treated as specifically separable.

Microsciurus isthmius vivatus *Goldman.*

Microsciurus isthmius vivatus Goldman, Smithson. Misc. Coll., LX, No. 2, p. 4, Sept. 20, 1912.

Type locality.— Near Cana, in the Pirri range of mountains, eastern Panama; altitude 3500 feet.

Geographic distribution.— Known only from the type locality.

Description.— Similar to *M. isthmius isthmius*, but upperparts paler and more olivaceous, and underparts orange buff instead of deep ferruginous. The difference in coloration between these two forms is nearly parallel to that between *M. mimulus* and *M. palmeri*.

Total length (collector's measurements), 260; head and body, 147; tail vertebræ, 113; hind foot (with claws), 38. Average of two adult topotypes, 239 (236–243); head and body, 129 (126–133); tail vertebræ, 110 (110–110); hind foot, 36 (35–37). Skull (type), occipitonasal length, 38.2; zygomatic breadth, 22.5; interorbital breadth, 13.4; breadth of braincase, 18; length of nasals, 10.7.

Specimens examined, 3, the type and two topotypes (Biol. Surv.).

Remarks.— As rightly said by the author (*l. c.*): "The occurrence of these widely differing pigmy squirrels [*M. alfari venustulus* and *M. i. vivatus*] in close proximity on the slopes of the Pirri range of mountains seems to show that the forms typified by *alfari* and *isthmius* belong to two distinct groups."

Microsciurus mimulus *Thomas.*

Sciurus (*Microsciurus*) *mimulus* Thomas, Ann. and Mag. Nat. Hist. (7), II, p. 266, Sept. 1898.

? Sciurus rufoniger Pucheran, Rev. zool., 1845, p. 336. Santa Fé de Bogotá, Colombia. Not *S. rufoniger* Gray, 1842, nor of Allen, 1877, nor of Alston, 1878. (See above, p. 152.)

Funambulus pucheranii Fitzinger, Math. Nat. Cl. K. Acad. Wiss. Wien, LV, p. 487, 1867 = *Sciurus rufoniger* Pucheran, renamed.

Type locality.— Cachavi, Esmeraldas, Ecuador; altitude about 665 feet.

Description.— "General colour deep brown, profusely grizzled with yellowish fulvous and with a marked black dorsal stripe. Crown and nape indistinctly blackish. Ears finely edged with fulvous; no whitish postauricular patch. Shoulders grizzled fulvous, with a tinge of rufous. Dorsal line shining black and strongly marked on the middle of the back, fading away anteriorly and posteriorly. Throat and chest rich fulvous, passing on the belly into blackish grizzled olivaceous grey. Limbs like back, the tips of the digits fulvous; inner sides of hips also more fulvous than the belly. Tail-hairs ringed with fulvous and black; their tips dull yellowish [in some specimens whitish]."

"Dimensions of the type (an adult female, measured in the flesh by the collector): [Total length, 239]; head and body 130 mm.; tail 109; hind foot without claws, 33; ear, 16.

"Skull: greatest length 38; basilar length 29; greatest breadth 23; nasals 10.6 × 5; interorbital breadth 13.5; interparietal 4 × 9; palate length from henselion 15.8; diastema (to p^4) 9.5; length of upper toothrow (excluding p^3) 5.6." — Thomas, *l. c.*

Specimens examined, 15.— Ecuador: Cachavi, 3, type and 2 topotypes (Br. Mus.); Ventano, 1 (Br. Mus.); Carondelet, 3 (Br. Mus., 1, Nat. Mus. 2); San Javier, 2 (Br. Mus., 1, Nat. Mus., 1); Lita, 1 (Br. Mus.).

Colombia: Barbacoas, 5 (Am. Mus.).

Remarks.— Seven specimens in the British Museum, all from northwestern Ecuador, collected at altitudes ranging from 60 to 500 feet, are fairly uniform in coloration and measure as follows: Total length, 246 (239–255); head and body, 136 (130–146); tail vertebræ, 109 (107–113); hind foot (without claws), 33 (31–34); ear, 14 (12–16). Three of them are from Cachavi (Rosenberg), the type locality; 1 from Ventano, 1 from Carondelet, 1 from San Javier (all collected by Fleming), and 1 from Lita. In addition to these are 3 borrowed from the U. S. National Museum (coll. Fleming), two of which are from Carondelet and one from San Javier. These are typical, the black dorsal stripe extending from the base of the tail to the top of the head, about as far as to the eyes. They may all be considered as typical of true *mimulus;* all were collected not far from the type locality.

Another series of 5 specimens from Barbacoas, Colombia (Am. Mus.), are not all typical. One of the five has a black dorsal band and is in all respects typical. Another has the dorsal band faintly indicated, while the whole top of the head is dusky. Another has the top of the head blackish and an indistinct dorsal band extending backward from it as far as the middle of the back. The other two have the whole top of the head blackish but no darkening of the median line of the back. The ventral surface is very

nearly as in typical *mimulus*. Barbacoas is only about 50 to 60 miles north of the type locality of *mimulus* yet the approach in coloration of the upperparts toward *palmeri* is unmistakable. But there is considerable difference in size between *mimulus* and *palmeri*, and in the color of the ventral surface, which is less heavily washed with a lighter shade of rufous in *mimulus* than in *palmeri*. The general color of the upperparts and the blackish head are the same in both series, except that the black on the head is more intense in typical examples of *palmeri*. What the phase is that inhabits the coast region between Barbacoas and the Chocó country is as yet unknown, but it seems not unlikely that in this coast strip complete intergradation may be found to occur between *mimulus* and *palmeri*.

Microsciurus palmeri *Thomas.*

Sciurus (*Microsciurus*) *palmeri* Thomas, Ann. and Mag. Nat. Hist. (8), IV, p. 234, Sept. 1909.

Type locality.— Sipi, Rio Sipi, tributary of Rio San Juan, Chocó district, Colombia; altitude 150 feet.

Description.— Upperparts as in *mimulus*, a little darker in some specimens, except that there is a black cap and no black median line, underparts ochraceous rufous, deepest on the chest; not chest region orange and the ventral area dark grizzled olivaceous gray with a slight wash and a median line of pale orange, as in *mimulus*. Size larger than in *mimulus*.

Total length (type and paratypes, collector's measurements, 270 (258–284); head and body, 149 (142–153); tail, 120 (116–130); hind foot (without claws), 37.5 (36–39); ear, 14.3 (13.5–15). (The few American Museum specimens with fully developed black caps and trustworthy measurements fall within these limits.) Skull (type), occipitonasal length, 40.3; zygomatic breadth, 24; interorbital breadth (not given); length of nasals (not given). Two other specimens (Nóvita, 1; San José, 1), occipitonasal length, 39.3, 39.2; zygomatic breadth, 22, —; interorbital breadth, 12.5, 13; breadth of braincase, 19, 19; length of nasals, 10.5, 11.2.

Specimens examined, 12.— Colombia (Chocó district): Sipi, 2 (type and topotype); Nóvita, 4 (2 Br. Mus., 2 Am. Mus.); Cajon, 2 (Br. Mus.); Boca de Guinco, 1 (Br. Mus.); San Joaquin, 1 (Br. Mus.); San José, 1 (Am. Mus.); Buenavista Noriña, 1 (Am. Mus.).

Remarks.— Of 8 specimens (type and paratypes) in the British Museum, four (2 males, 2 females) have the black cap intensely black and sharply defined; two others (males) have the hairs of the cap minutely tipped with rufous, veiling the cap; the other (male) has the head uniform with the

back, with no indication of a darker crown. A single specimen (male) in the U. S. National Museum is similar to the last. These specimens are all from localities near Nóvita in the Chocó district at altitudes of 100 to 200 feet.

Of 4 specimens in the American Museum (3 males, 1 female), all have the black cap, but it is less intense and less sharply defined in the female. Two are from Nóvita, 1 from San José, and 1 from Buenavista Noriña, all these localities except the last being below 200 feet altitude.

Microsciurus simonsi *Thomas.*

Sciurus (Microsciurus) simonsi Thomas, Ann. and Mag. Nat. Hist. (7), VI, p. 294, Sept. 1900.

Type locality.— Porvenir, near Zaparal, Bolivar province, Ecuador; altitude, 1500 m. (5000 feet).

Geographic distribution.— Known only from the type locality.

Description.— "General colour above grizzled olivaceous, about as in *S. alfari*, though slightly darker. Under surface also very much as in that species, the hairs tipped with buffy, not ferruginous. Sides of nose yellowish. Eyes with marked yellowish rings round them. Ears well-haired without lighter spots behind them, dark rusty red. Feet grizzled yellowish. Tail fairly long-haired, the hairs ringed black and reddish basally, with black subterminal and dull yellow terminal rings."

"Head and body, 138 mm.; tail 112, hind foot, s. u. 35, c. u. 38; ear 16.

"Skull, greatest length, 38.8; .... greatest breadth 23.5 ...." — Thomas (*l. c.*).

Specimens examined, 1, the type.

Remarks.— About equals *M. mimulus palmeri* in size, but the skull is shorter and much broader than in *palmeri* and the braincase much more highly arched.

Microsciurus peruanus *Allen.*

Sciurus (Microsciurus) peruanus Allen, Bull. Amer. Mus. Nat. Hist., IX, p. 115, April 26, 1897.

Type locality.— Guayabamba, northwestern Peru; altitude 4000 feet.

Geographic distribution.— Known only from the type locality.

Description.— Upperparts dusky olivaceous, the hairs on the body tipped minutely with olivaceous and on the head and shoulders with yellowish rufous; underparts washed with yellowish rufous, heavily on the chest and upper abdomen, paler on throat and lower abdomen; back of ears pure

white, and a fluffy postauricular white patch; an indistinct yellowish eye-ring; upper surface of feet dusky minutely punctated with yellowish; tail hairs above at base reddish brown, subapically broadly banded with black and tipped with whitish, below blackish, tipped with whitish. Nasals squarely truncate posteriorly.

Total length (type, measured from skin), 240; head and body, 130; tail vertebræ, 110; hind foot, 38. Skull, occipitonasal length, 36; zygomatic breadth, 21.3; interorbital breadth, 13; breadth of braincase, 18; length of nasals, 9.

Specimens examined, 1, the type.

Remarks.— Easily recognized by its conspicuous white postauricular patches and the dark coloration of the upperparts, the hairs of upperparts of body narrowly tipped with olivaceous.

Microsciurus kuhlii (*Gray*).

Macroxus kuhlii Gray, Ann. and Mag. Nat. Hist. (3), XX, p. 433, Dec. 1867.

S[ciurus] kuhlii (Gray) Nelson, Proc. Washington Acad. Sci., I, p. 32, May 9, 1899 (in text). Referred to *Microsciurus.*

Type locality.— "Brazil (Castelnau)." Probably upper tributaries of the Amazon.

Geographic distribution.— Distribution unknown. Collected by Castelnau, who crossed Brazil twice on his well-known Expedition to South America during the years 1843 to 1847,— from Rio de Janeiro to Lima and from Lima to Para, via Cuzco and the rivers Urubamba, Ucayali, and Amazon, thus traversing the range of *Microsciurus* on the upper tributaries of the Amazon, where a species of this genus (*M. peruanus*) occurs with white postauricular patches and a white-fringed tail. It seems therefore probable that the type of *M. kuhlii* came from some point on the Ucayali River above or near the mouth of the Rio Napo, or possibly in the Andes west of Cuzco.

Description.— "Fur soft, nearly uniform olive, slightly washed with yellowish: chin and underside rather paler and yellower; a white spot above the base of each ear; tail blackish, whitish-washed; hairs yellow, with a broad subterminal band and white tip.

"*Hab.* Brazil (Castelnau), B. M." — Gray, *l. c.*

Specimens examined, none.[1]

Remarks.— It is possible that the name *kuhlii* should replace my name

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[1] So far as I remember, I did not examine the type of Gray's *Macroxus kuhlii,* in the British Museum; at least, I find no mention of it in my notes, and probably overlooked it. Mr. Thomas has kindly informed me (*in litt.*) that the premolar formula is $\frac{2}{1}$.

peruanus; the two supposed species are certainly closely related, judging from Gray's description of *kuhlii* and Alston's later reference (Proc. Zool. Soc. London, 1878, p. 670, June 18, 1878) to it. Both are similar in general coloration, and both have white postauricular patches and the tail fringed with white.

The type locality of *kuhlii,* however, is not known, but was probably in the Andean region of Peru somewhere between Lima and Cuzco, while the type locality of *peruanus* is in northwestern Peru. Pending an opportunity for direct comparison of the types of the two species both are here provisionally retained.

Microsciurus napi *Thomas.*

Sciurus (*Microsciurus*) *napi* THOMAS, Ann. and Mag. Nat. Hist. (7), VI, p. 295, Sept. 1900.

Type locality.— Mouth of Rio Coco, upper Rio Napo, on the Ecuador-Colombia boundary.

Geographic distribution.— Known only from the type locality.

Description.— Upperparts faintly washed with rusty fulvous, much more pronounced than in *M. peruanus;* underparts faintly washed with fulvous; tail edged with fulvous, not whitish-edged as in *peruanus;* posterior surface of ears and postauricular patches white as in *peruanus.*

Head and body (type, measured from dry skin), 157; tail (imperfect); hind foot (without claws), 34. Skull (imperfect), zygomatic breadth, 21; interorbital breadth, 13; length of nasals, 9.

Specimens examined, 1, the type, a slightly immature female.

Remarks.— Nearly related to *M. peruanaus,* of which it may be only a subspecies, as described. The type locality, however, is remote from that of *peruanus,* at a much lower elevation, and in a very different faunal area. Further material is necessary before its relationship can be satisfactorily determined. The describer compared it with specimens incorrectly identified as *peruanus.*

Microsciurus rubrirostris sp. nov.

Type, No. 9, 7, 5, 4, British Museum, ♂ ad., Chanchamayo, central Peru; altitude 2000 m., Dec., 1907; coll. C. O. Schuke.

Upperparts dark brown, the tips of the hairs yellowish rufous; front of head to nose bright rufous; feet, shoulders, and edge of thighs strongly washed with yellowish rufous; chin and throat yellow deepening on chest and rest of ventral surface to orange ochraceous; back of ears and postauricular patch buff; tail blackish fringed with pale yellowish, the hairs rufous at base, subapically broadly banded with black and tipped with pale yellowish.

Total length (type, collector's measurements), 278; head and body, 145; tail vertebræ, 133; hind foot without claws, 35, with claws, 38; ear, 13. Skull, total length, 37; zygomatic breadth, 23; interorbital breadth, 13.4; breadth of braincase, 19; length of nasals, 10.

Another specimen in the U. S. National Museum, a topotype from the same collector (Schuke), measures as follows: Total length, 310; head and body, 160; tail vertebræ, 150; hind foot without claws, 35; ear, 15. Three other specimens in the British Museum, all topotypes, are without measurements. Number of specimens examined, 5.

This is a large species, much larger than *M. peruanus,* from which it differs in its strongly yellowish rufous coloration above, rufous instead of fulvous coloration below, deep buff instead of white postauricular patches, and in having a relatively much longer tail.

Microsciurus florenciæ sp. nov.

Type, No. 33695 (skin), No. 34370 (skull), ♂ ad., Florencia (altitude 1000 feet), Caquetá district, Colombia, Jan. 27, 1912; coll. Leo E. Miller.

Upperparts with the tips of the hairs rufous, giving a dark reddish brown general effect; sides of nose buffy; underparts grayish brown, faintly washed with tawny; upper surface of feet and the limbs like the body; postauricular patches large, white narrowly edged apically with pale buff; tail blackish edged with pale yellowish white, the hairs rufous at base, broadly ringed with black and tipped with whitish.

Total length (type, collector's measurements), 270; head and body, 150; tail vertebræ, 120; hind foot (with claws), 40. A male topotype, 250, 130, 120, 40. A female from Murelia (a nearby locality, alt. 600 ft.), 250, 130, 120, 40. Average of 3 specimens, 273, 143, 130, 40.

Skull (type), occipitonasal length, 40; zygomatic breadth, 23.7; interorbital breadth, 14; breadth of braincase, 18.8; length of nasals, 10. Two other skulls are slightly smaller and also younger. Rostrum broad and the posterior border of nasals squarely truncate in all the three skulls, instead of emarginate or V-shaped as in *M. rubrirostris,* and almost without exception in all other known species of the genus.

Microsciurus florenciæ is represented by four specimens, two from Florencia and two from Murelia. The collector's skull labels were unfortunately lost, but in all probability the skull selected for the type skull belongs with the skin with which it is here associated. The color of the ventral surface in the four specimens varies from whitish gray faintly tinged with tawny on the middle of the belly to a whitish tawny brown, entirely unlike that of any other species except *M. alfari browni* from Chiriqui, Panama. The upperparts are similarly colored in all of the four specimens. One of the skulls lacks the minute upper premolar.

Measurements of Species and Subspecies of Microsciurus.

	External Measurements					Cranial Measurements					
	Numb. of specimens	Total length	Head and body	Tail	Hind foot	Numb. of specimens	Greatest length	Zygom. breadth	Interorb. breadth	Breadth of braincase	Length of nasals
M. alfari alfari	Type	250	145	105	36.5	Type	36	22	13	19	10
M. alfari venustulus	"	250	148	102	40	"	37	23.2	14	17.6	10.5
M. alfari browni	"	260	140	120	38	"	36	21.2	12.4	—	11
M. boquetensis	"	257	141	116	37	"	—	—	14	—	—
M. similis similis	5	250	127	121	33	4	35.4	20.5	13.4	17.7	10
M. similis fusculus	Type	234	126	108	35	None	—	—	—	—	—
M. simonsi	"	250	138	112	38	Type	38.8	23.5	—	—	—
M. pusillus	None	—	—	—	—	None	—	—	—	—	—
M. otinus	Type	242	130	112	36	Type	—	22.7	13.3	—	10
M. chrysuros	None	—	—	—	—	None	—	—	—	—	—
M. isthmius isthmius	Type	—	150	—	37	Type	—	22	14.3	18	10
" " "	3	243	137	110	36	3	35.3	21.9	13.3	17.8	10.2
M. isthmius vivatus	Type	260	147	113	38	Type	38.2	22.5	13.4	18	10.7
" " "	2 top.	239	129	110	36	—	—	—	—	—	—
M. mimulus	Type	239	130	109	36	Type	38	23	13.5	—	10.6
" "	7	246	136	109	36	—	—	—	—	—	—
M. palmeri	8	270	149	120	40	Type	40.3	24	—	—	—
M. peruanus	Type	240	130	110	38	"	35	21.3	13	18	9
M. napi	"	—	157	—	37	"	—	21	13	—	9
M. kuhlii	None	—	—	—	—	None	—	—	—	—	—
M. rubrirostris	Type	278	145	133	38	Type	37	22	13.3	18.5	10
" "	1	310	160	150	40	1 top.	37	23	13.4	19	10
M. florenciæ	Type	270	150	120	40	Type	40	23.7	14	19	10
" "	3	273	143	130	40	3	38	22.8	13.8	18.8	10

59.82 (86)

Article XII.— DIAGNOSES OF APPARENTLY NEW COLOMBIAN BIRDS,[1] II.

By Frank M. Chapman.

Plate XIII. Sketch-map of Southwestern Colombia.

Continued work on the birds secured by the Museum's expeditions in western Colombia showed that in many instances satisfactory identification was not possible without comparison with freshly collected material from what is known as the 'Bogotá Region,' whence at least 200 species of birds have been described. Many of these species are, it is true, represented in our Museum by the characteristic, native-made 'Bogotá' skins. These, however, are not only without data, but in a large number of cases, they have so changed color that their scientific value has been destroyed. They are, in fact, worse than useless since comparison with them may lead to erroneous conclusions.

An expedition was therefore despatched to Bogotá on January 6, 1913, and it returned to New York early the following May. It was in charge of the writer who was accompanied by George K. Cherrie, Louis A. Fuertes, Thomas M. Ring, Paul G. Howes and Geoffroy O'Connell. Collecting was begun in the Magdalena Valley and pursued at a number of stations across the Eastern Andes through Bogotá to Villavicencio, at their eastern base. Some 2300 specimens, representing somewhat over 500 species, were secured, a number indicating the remarkable richness of the avifauna of the region.

In due time, in addition to a general summary of the results of our explorations in Colombia, it is proposed to publish a special paper on our work in the Bogotá region, in which the subject of change of color in native-made skins, the limits of the 'Bogotá' region and its faunal characteristics will be treated.

With this new material I have resumed the study of our now extensive Colombian collections, but the task of critically examining some 11,500 specimens of birds is a large one and will require much time. It is, therefore, planned to issue, as occasion requires, papers which, like the present, contain descriptions of proposed new species, with the double object of retaining the types for the American Museum and of securing criticism on the views set forth, in advance of the appearance of the final report.

For the loan of specimens used in the preparation of this paper cordial

[1] See also Diagnoses of Apparently New Colombian Birds. Bull. Amer. Mus. Nat. Hist., XXXI, pp. 139–166, July 23, 1912.

acknowledgments are due Dr. Chas. W. Richmond of the United States National Museum, Dr. Witmer Stone of the Philadelphia Academy of Natural Sciences, Mr. Outram Bangs of the Museum of Comparative Zoölogy, Mr. W. E. Clyde Todd of the Carnegie Museum, and Mr. C. B. Cory of the Field Museum.

Ridgway's 'Color Standards and Color Nomenclature'[1] has been employed in describing plumages.

Ortalis columbiana caucæ subsp. nov.

Char. subsp.— Similar to *O. c. columbiana* Hellm., but with the forehead little if any paler than the crown, the lower back, rump, flanks, crissum and under tail coverts more strongly rufous chestnut; feet horn color instead of red.

Type.— No. 108673, Am. Mus. Nat. Hist., Guengüe, Cauca Valley, 20 miles south of Cali, May 5, 1911; F. M. Chapman.

Remarks.— Hellmayr[2] states that an examination of the type of Wagler's "*Ortalis caracco*" shows it to be closely allied to, and perhaps identical with *Ortalis albiventris* of eastern Brazil, and that consequently Grant[3] was in error in applying this name to the Colombian bird which he therefore (*l. c.*) separates under the name *Ortalis columbiana.* There appear, however, to be two well-marked forms of this species in Colombia one of which occurs east of, the other west of the Central Andes. Hellmayr's type is unfortunately without locality, but his description seems to apply to the eastern rather than to the western bird, which has the forehead of essentially the same color as the crown and not "weisslichgrau," as Hellmayr describes his type.

While the under tail-coverts of all our eleven specimens of the bird which I assume to be true *columbiana* show sufficient rufous-chestnut to correspond with Hellmayr's description of this part as "kastanienrot," none has the character so strongly developed as in our four specimens of *caucæ* in which this color spreads to the lower ventral region, flanks and sides of the rump.

If my understanding of the case be correct, *columbiana,* therefore, is the bird of the Bogotá region (3 specimens) and upper Magdalena Valley (San Agustin, La Candela, Andalucia, 5000 ft. (9 specimens), while *caucæ* occupies the Cauca region where it is locally common in the valley and ascends to the border of the Subtropical Zone (Guengüe, 1; La Manuelita, 1; San Antonio, 2, "legs and bill gray").

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[1] Color Standards and Color Nomenclature. By Robert Ridgway, with 53 colored plates and 1115 named colors. Washington, D. C., 1912. Published by the author.

[2] Abhandl. Akad. München, XXII, 1906, p. 694.

[3] Cat. B. M., XXII, p. 509.

Porphyriops melanops bogotensis subsp. nov.

Char. subsp.— Similar to *P. m. melanops* but axillars not barred, the upperparts darker, the interscapulars in the adult largely chestnut, like the wing-coverts.

Type.— No. 121412, Am. Mus. Nat. Hist., ♂ ad., Savanna of Bogotá, Colombia Feb. 18, 1913; T. M. Ring.

Remarks.— In addition to the type I have an adult female (with all the wing-quills in the sheaths) collected by Howes, an adult female and immature male collected by Fuertes, and an old, but well-preserved, 'Bogotá' skin of an adult. In one of the five Bogotá specimens the axillars are wholly white, in the others they are dusky basally with a spot or two toward the tip, but in none are they barred.

Of *P. m. melanops*, the National Museum has supplied one specimen from Paraguay, one from the Parana and one from Conchitas, near Buenos Aires, and one from Chile, while two additional specimens from Chile are in the American Museum collection. Four of these specimens have the axillars crossed by four or five bars, in the fifth the bars do not fully cross the feathers. An adult from Temuco, Cautin, Chile (Am. Mus. 113373) is considerably larger (wing, 136; tail, 61; tarsus, 45; middle toe culmen, 34 mm.) than either Paraguay or Bogotá birds (which agree in size) and is more olive above than two birds entering adult plumage from Conchitas and Paraguay. All three specimens agree, and thereby differ from Bogotá adults, in lacking chestnut on the interscapular region.

Of the several names which have been applied to this species none appears to be applicable to the form here described. *Fulica crassirostris* Gray,[1] from "South America" is described as having "the mantle and quills deep brown;" "the wing-coverts and the irides bright brown." The description of the bill as "remarkably high" and its appearance in the plate following the text, suggests that possibly the large Chilian form was here referred to.

Crex femoralis Tschudi,[2] the habitat of which is given as "in sylvis apud flumen Tullumayo," is described as having the back olivaceous."

Porphyriops leucopterus Salvad.,[3] based on two specimens in the Museum of Turin (No. 4405 Arg. Republic; No. 5658 "Amer. Merid." probably Buenos Aires) is evidently a pure synonym of *melanops* Vieill. of Paraguay, which is based on Azara. The character of margined tertiaries claimed for this form is shown by specimens from Paraguay, Chile and Bogotá, never-

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[1] Griffiths' Cuvier's Animal Kingdom, III, 1829, p. 542, pl.

[2] Arch. für Nat., 1843, p. 388.

[3] Atti Soc. Ital. Nat., VIII, p. 382, 1865. I have to thank Mr. Witmer Stone for investigating this reference for me.

theless, Sclater (P. Z. S., 1868) states that *leucopterus* is different from *melanops* but may be identical with *femoralis*. He adds: "There is a specimen of this bird in the Derby Museum, Liverpool, from Bogotá. It seems to be a good second species of the genus *Porphyriops*." While, therefore, Sclater recognized the distinctness of the Bogotá form, he misapplied to it the name *leucopterus*, which, as we have just seen, is a synonym of *melanops*.

Fulica americana columbiana subsp. nov.

Char. subsp.— Similar to *F. a. americana*, but tarsi and toes longer, bill heavier and longer, frontal shield larger, higher, rounded posteriorly and more clearly defined from the bill anteriorly; bill basally, in breeding specimens, yellowish; plumage, particularly of the underparts, darker, more slaty, the under wing-coverts darker and with little or no white edgings; the white at the ends of the inner secondaries averaging less in extent and confined largely to the inner web of the feathers.

Type.— No. 126404, Am. Mus. Nat. Hist., ♂ ad., La Herrera (alt. not stated), N. of Bogotá, Cundinimarca, Colombia, May 13, 1913; Manuel Gonzales.

Remarks.— Of this well-marked form we have thirteen specimens collected at La Herrera and La Olanda in Cundinimarca north of Bogotá on May 11 and 13, 1913. Of this number eleven are fully adult, one is immature, and one is molting from juvenal into 'first winter' plumage. The collector made no note of the colors of the bill and shield in life, but two months after death the shield is dull, dark maroon approaching diamine-brown, the bill to the anterior margin of the nostrils is olive-ochre, its surface more or less scaly, the tip and commissure as far backward as a point opposite the middle of the nostril horn-color, marked on the maxilla by a band, on the mandible with two quadrate spots (separated by the gonys) of approximately the same color as the shield.

It is possible that the differences in general color mentioned may be in part attributed to the greater age of our skins of *americana*. Since, however, they are more pronounced on the underparts than above, it is probable that to some extent, at least, they actually exist.

In *Fulica caribæa*, of which the National Museum has loaned me six specimens, including the type, the shield appears to be yellowish or orange, of the same color as the bill, from which it is not sharply defined as in *columbiana*. In other words, the shield in *caribæa* might be described as a basal inflation of the culmen with which it is continuous, while in *columbiana* it is a dark maroon ellipse set on the forehead and clearly distinct from the base of the culmen both in color and structure. Indeed so far as the shape and color of the shield is concerned, *columbiana* more nearly resembles *americana* than it does *caribæa*, and it is even nearer, in this respect, to

certain specimens of *Fulica ardesiaca*. In *ardesiaca* the bill and its shield are much larger, as might be expected, the tip of the bill is greenish and its broken band is lacking, but aside from these differences the bill of *ardesiaca*, in general proportions and in the color and isolation of the shield, strongly suggests that of *columbiana*.

It is true that *ardesiaca* is placed in that section of the genus containing species with no white on the secondaries, nevertheless a trace of this character is usually present and this fact in connection with the reduced amount of white in the secondaries of *columbiana* and the resemblance in the bill of the two species just mentioned, points to the conclusion that *ardesiaca* is a representative of *americana*.

From *F. leucoptera*, *columbiana* differs in its larger size, particularly of feet and bill, in the color of the bill and shield (both yellow in *leucoptera*) and in its more elevated and clearly defined shield. The Hawaiian *F. alai*, the remaining species of *Fulica* having the secondaries tipped with white, agrees with *leucoptera* in the color of the bill, but has this member larger and with a more inflated frontal shield.

Measurements.

		Tarsus	Middle-toe	Culmen from base of shield	Depth of bill at ant. margin of nostril	Shield Length	Shield Width
columbiana,	♂	60	91	48.5	10.5	16	8.2
"	♂	60	93	53.5	12	18.5	11.5
"	♂	60	90	48	11	16	8
"	♂	64	96	49	11	15	10.5
"	♀	63	90	54	12	20	12
americana,[1]	♂	59	87.8	45	10.8	8	9.5
"	♂	53	80.5	46.5	9.5	13	8.6
"	♂	56	85	49.4	10.5	10.5	9.3
"	♀	49	74.5	44	9.3	12.2	9.5
"	♀	54	81	44.5	9.8	9.7	7

Ixobrychus exilis bogotensis subsp. nov.

Char. subsp.— Similar to *I. e. exilis* but slightly smaller; adult male in breeding plumage with the underparts more richly colored; the breast, abdomen, flanks, under wing and under tail-coverts warm buff, the thighs deeper in tone; the median and lesser wing-coverts richer, mainly ochraceous buff more or less margined with tawny-russet; adult female more nearly resembling adult female of *I. e. exilis* but the abdominal region, flanks, thighs, under wing and under tail-coverts deeper, warm buff; the back slightly darker; immature male much richer in color than *I. e. exilis* of same age; underparts heavily washed with ochraceous-buff; central wing-covert

[1] Spring adults from New York, Iowa, and Minnesota.

area ochraceous tawny; in adult and immature, tarsi black, toes brownish, their soles yellowish.

Type.— No. 121432, Am. Mus. Nat. Hist., ♂ ad., testes much enlarged, Suba Marshes, Bogotá, Colombia, February 17, 1913; F. M. Chapman.

Measurements.

	Wing	Tail	Tarsus	Culmen
Ad. ♂.	116	42	38	40
Ad. ♀.	113	43	37	37
Im. ♂.	116	43	40	38

Remarks.— *Ixobrychus exilis* is apparently a rare bird in South America. It is not included in Brabourne and Chubb's 'List of the Birds of South America' (1912), but is stated in the A. O. U. 'Check-List,' (1910), to occur as far south as Brazil. The discovery of a local race of this boreal species on the Bogotá Savanna is therefore a fact of rather exceptional interest. An apparently mated pair, both having the sexual organs enlarged, was taken on February 17, and an immature male, taken January 21, was purchased by Mr. Fuertes from a local collector. Doubtless the bird is not uncommon in the reedy marshes of the Savanna, but strangely enough it appears not before to have been recorded from the Bogotá region. While there is little probability of actual intergradation between this new form and *exilis* proper, it is so obviously a representative of *exilis* that its relationships and status appear to be more correctly expressed by a trinomial rather than binomial designation.

The Bogotá form shows some approach to the apparently specifically distinct *I. erythromelas* in the richer color of the underparts, but the female is wholly unlike it in the color of the back, which is rich chestnut in *erythromelas*, and clove-brown in *bogotensis*.

Stenopsis cayennensis monticola subsp. nov.

Char. subsp.— Wings and tail longer, the bill larger than in *S. c. cayennensis*, the female much darker throughout, the crown largely black, the central feathers but narrowly margined with rusty or ochraceous-tawny and grayish; the grayish nuchal area almost wanting, the rusty nuchal collar slightly deeper in color; in the back black predominates, the grayish is reduced to a minimum the feathers being minutely marked with broken rusty; scapulars black widely margined externally with buff or ochraceous as in *cayennensis*, black tail-bars wider and more pronounced, breast and flanks more heavily barred.

Type.— No. 107747, Am. Mus. Nat. Hist., ♀ ad., San Antonio (alt. 6600 ft.). Western Andes, above Cali, Colombia, Jan. 23, 1911; W. B. Richardson.

Remarks.— Unfortunately none of our four specimens of this race, which may merit the rank of a species, is an adult male. An immature male has the inner web of the outer rectrix white tinged with buffy on the margin and with three small longitudinal black marks near the shaft in the central part of the feather, the second pair of feathers is barred with rusty and black, the third is similarly barred on the outer web but is more solidly black toward the end at the tip of both webs; the inner web, except for the tip, is buffy white with a strong bar of black in the middle reaching nearly across it, the fourth pair resemble the third but lacks the black bar.

I have no males of *cayennensis* in similar plumage for comparison, but the presence of the black bar on the third pair of feathers indicates that the bird here named is nearer to that species than to *Stenopsis albicauda* the adult male of which (type, loaned by the Nat. Mus.) has no black bar crossing the white vane of the tail-feathers as in *cayennensis*.

From the female of *S. albicauda*, a Costa Rican specimen of which has been loaned by Mr. Todd, *monticola* differs in being darker above and much deeper buff below. The differences in the plumage of the upperparts are not so striking as those which exist between *monticola* and *cayennensis*, the female of the latter being considerably lighter than the female of *albicauda*, but below, the differences are greater since the underparts of *albicauda* are paler than those of *cayennensis*.

The exact relationships of *monticola*, however, cannot be determined until the adult male has been secured, but its well-defined characters and the fact that it apparently occurs in the Subtropical Zone, while *cayennensis* has been recorded only from the lower or Tropical Zone, suggests the possibility of the specific distinctness.

Measurements of Females.

	Wing	Tail	Culmen	Breadth of bill at nostril
San Antonio, W. Col. ♀	139	104	12.5	6 mm.
" " ♀	138	106	13	6
" " ♂ im.	138	112	12	6
Maripa, Rio Caura, Ven.	135	100	10	5
" " "	134	97	11	5
Cayenne, F. Guiana ♂ ad.	132	108	11	5.5

Formicarius analis connectens subsp. nov.

Char. subsp.— Most nearly related to *F. a. saturatus* Ridgw. but cinnamon at the sides of the throat wholly absent or but faintly indicated; upperparts less rufescent, more olivaceous, breast slightly darker, throat patch less sharply defined, size smaller. ♂, wing, 86; tail, 52; tarsus, 31.5; culmen, 18.

Type.— No. 121961, Am. Mus. Nat. Hist., ♂ ad., Villavicencio (alt. 1600 ft.), eastern base of Eastern Andes, Colombia, March 12, 1913; T. M. Ring.

Remarks.— This interesting and strongly marked form is based on three males from the type locality, while two females and a male from La Murelia, at the eastern base of the Andes further south, though slightly deeper above obviously belong to the same race. Of true *analis* I have but one specimen, which, however, being from Bolivia (Yungas) may doubtless be considered typical. It is unsexed, but appears to agree in size with the race here named. From this specimen of *analis, connectens* differs in color in being decidedly darker, particularly below, where *analis* is much paler than *saturatus.* It is, however, the presence of a trace of cinnamon at the sides of the throat in two of our specimens of *connectens* that suggests its being a connectant between *analis* and the other northern forms in which this cinnamon marking becomes highly developed. Further characters indicative of the close relationships of these birds are the white loral mark present in our specimen of *analis,* in all six specimens of *connectens* and all of our eleven Trinidad specimens of *saturatus,* and the basally olivaceous or rufescent, apically black tail of *analis, connectens* and all the northern forms placed by Ridgway (Bull. 50, V, 1911, p. 117) under *moniliger.* Additional evidence of the intergradation of the Bolivian with the more northern races is supplied by a specimen from Sarayacu, southeastern Ecuador (not "northeastern Peru") which Ridgway refers to as a probable local race of *analis* and which from his description (Proc. U. S. Nat. M., 1893, p. 674) is evidently between that form and *connectens.*

It may be added that, in my opinion, *Formicarius nigricapillus* is specifically distinct from *analis;* but the relationships of this bird will be discussed in the final report on our Colombian collections.

Craspedoprion pacificus sp. nov.

Craspedoprion æquinoctialis (not of Scl.) Hellm., P. Z. S., 1911, p. 1127 (Nóvita, Noanamá, Col.).

Rhynchocyclus æquinoctialis (not of Scl.) Hart., Nov. Zoöl., 1898, p. 48, (Cachibi, northwest Ecuador).

Char. sp.— Similar to *C. olivaceus* in size but color brighter above, the margins to wing-coverts and inner wing-feathers deeper, more tawny, the breast much darker, the belly deeper yellow.

Type.— No. 112208, Am. Mus. Nat. Hist., ♂ ad. (testes enlarged), Juntas de Tamaná (alt. 400 ft.), Rio San Juan, Chocó, Western Colombia, Dec. 18, 1911; A. A. Allen and L. E. Miller.

Description of Type.— Above uniform rich olive-green, the loral and auricular regions not perceptibly different, the upper tail-coverts more fuscous and margined with ochraceous; tail fuscous margined externally with olive-green of a browner

shade than that of the back, internally faintly buffy decreasing in amount from without inwardly; wing-quills much blacker than rectrices, all but the outer primary margined with olive-green growing more ochraceous inwardly and apically and becoming ochraceous-tawny on the apical third of the tertials and outer margins of the greater wing-coverts; inner web of all but outer primary buffy, increasing in extent inwardly and becoming cinnamon-buff on the inner feathers; bend of wing greenish yellow; under wing-coverts dusky yellow; throat and upper breast yellowish oil-green; sides and flanks somewhat more dusky, center of belly citron-yellow streaked with oil-green anteriorly and laterally; thighs olive-green; under tail-coverts dusky yellowish, lower mandible whitish-horn, upper, black. Wing, 75; tail, 65; tarsus, 18; culmen, 15; breadth of bill at nostril, 10 mm.

Range.— Humid Tropical Zone of Pacific Coast of Colombia, and Ecuador.

Remarks.— Previous authors have commented on the characters of this species but evidently through lack of material have referred it to *C. æquinoctialis.* Comparison of five specimens from the Pacific coast of Colombia (Juntas de Tamaná, 1; Chocó, 1; Nóvita, 1; Barbacoas, 2) with four specimens from the Caquetá district (La Murelia, 3; Florencia, 1) in the same faunal region as "Napo," the type-locality of *æquinoctialis,* shows the two forms to be specifically distinct. Aside from its much larger size, *C. pacificus* is brighter green above and brighter yellow below, the throat and chest are darker and more solidly oil-green, and, as has been remarked by the authors quoted, the margins of greater coverts and inner quills are ochraceous-tawny rather than olive-yellow.

The specific distinctness of *pacificus* is indicated not only by its characters but by its distribution. Like other members of this group it appears to be restricted to the Tropical Zone and hence is widely separated geographically from *æquinoctialis,* which is unknown west of the Tropical Zone at the eastern base of the Eastern Andes. At the north the range of *pacificus* is bounded by that of quite a different form to which the name *æquinoctialis* has also been misapplied and which is described below as *C. æquinoctialis flavus.*

Panama specimens of this race are much nearer the Caquetá specimens of *æquinoctialis* than they are to specimens of *pacificus* from the upper Atrato and upper San Juan and whether or not they may be representative forms it is reasonably certain that they do not now intergrade.

Craspedoprion æquinoctialis flavus subsp. nov.

Craspedoprion æquinoctialis (not of Scl.) Ridgw. (part), Bull. 50, Part IV, U. S. N. M., 1907, p. 387.

Rhynchocyclus æquinoctialis (not of Scl.) Allen, Bull. A. M. N. H., 1900, p. 146 (Onaca, Santa Marta Mts., Col.).

Char. subsp. Similar to *C. æ. æquinoctialis* (Scl.) but larger, the upperparts

brighter, the breast more yellowish, less grayish green, the belly more extensively, and somewhat brighter, yellow.

Type.— No. 70912, Am. Mus. Nat. Hist., ♂ ad., Onaca (alt. 2500 ft.), near coast in Santa Marta Mts., Colombia, Dec. 28, 1898; Mrs. H. H. Smith.

Range.— Caribbean district of South America from Panama to northeastern Venezuela and probably farther south.

Remarks.— Lack of authentic specimens of *C. æquinoctialis* has evidently led to the erroneous identification of birds from Panama and northern Colombia as that species, whereas when compared with four specimens (La Murelia, 3; Florencia, 1) from near the type-locality ("Napo") of *æquinoctialis* they are found to differ conspicuously as above indicated. Two Panama specimens are slightly smaller than two from Onaca, near Santa Marta, and one from Cristobal Colon at the eastern end of the Paria Peninsula, while agreeing in size with the Santa Marta specimens, is slightly darker; it shows, however, no approach to *C. guianensis*, with which Mr. Todd, who has loaned me four specimens from the Caura and Yuruan in eastern Venezuela, tells me his *C. intermedius* (Ann. Carn. Mus. VIII, 1912, p. 207) is synonymous.

Craspedoprion guianensis, evidently a northern form of *C. olivaceus*, resembles *C. æquinoctialis* in size but is slightly paler below, has the tail browner, the inner margins of the wing-coverts more buffy and outer margins of the greater coverts more ochraceous. It is not improbable that *olivaceus* and *æquinoctialis* may intergrade, but *C. brevirostris* of Central America and *C. pacificus* of the Pacific coast of Colombia and northern Ecuador, appear now to stand as species.

Measurements.

			Wing	Tail	Culmen
C. æ. æquinoctialis,	Murelia, Col.,	3 females	65–69	54–58	13–14
" " "	Florencia "	♂	72	61.5	14
" " *flavus*	Onaca, "	♂	76	66.5	14
" " "	" "	♂	74	62	15
" " "	Panama	♀	71	58	14
" " "	Cristobal Colon, Ven.	♂	75	66	15
C. pacificus	Juntas de Tamaná, Col.	♂	74	66	15
" "	Chocó "	♂	79	69.5	15
" "	Nóvita "	♀	72	59	16
" "	Barbacoas "	♂	79	68	15

Euscarthmus septentrionalis sp. nov.

Char. sp.— Similar to *Euscarthmus impiger* Scl. & Salv. but upperparts much grayer, the bill slightly smaller, more subulate, and blackish brown.

Type.— No. 122189, Am. Mus. Nat. Hist., ♂ ad., Honda (alt. 600 ft.), Central Magdalena Valley, Colombia, Feb. 3, 1913; George K. Cherrie.

Description of Type.— Crown brownish olive with a strong grayish tinge, passing without abrupt transition through a slightly more olivaceous color on the back to a distinctly brighter olive-green on the rump and upper tail-coverts; tail fuscous, outer pair of feathers margined externally with grayish, the others with olive-green, which is broader and brighter basally; wing-quills fuscous, the outer primary and inner tertials margined externally with whitish, the others with olive-green the fuscous wing-coverts broadly tipped with yellowish white; bend of the wing and under wing-coverts pale yellow; lores grayish; underparts white, chin and throat and upper breast lightly streaked with grayish, lower breast, particularly at the sides, washed with grayish; sides grayish obsoletely streaked, flanks tinged with greenish; thighs olive-gray; under tail-coverts white with a yellow tinge; legs and feet (in skin) amber brown; bill (in skin) dark chestnut brown, blacker apically, pale below. Wing, 50.5; tail, 41; tarsus, 20; culmen, 12.

Remarks.— In addition to the type we have a second male taken the same day at Honda, which agrees with it, and a specimen (No. 37080) in the Carnegie Museum, loaned me by Mr. Todd, taken by Carriker at Anzoategui, Estado Lara, Venezuela, Feb. 28, obviously belongs to the same species, but is in less worn plumage than the Honda specimens.

Of the bird which I take to be true *impiger*, our collections contain one specimen from Puerto Bello, Venezuela, and consequently near the type locality (= "near Caraccas") and 20 specimens from near Santa Marta, chiefly from Bonda.

From this series the three birds representing *septentrionalis* differ conspicuously in their blacker and, to a less degree, more rounded bill. This is described in the flesh by Carriker as "blackish brown, horn below," while Phelps describes the bill of the Puerto Cabello specimen as "upper mandible brown, lower, light brown." In comparable, unworn plumage, *impiger* has the crown and foreback deep buffy brown in strong contrast to the gray tinged brownish olive of *septentrionalis.*

The specific distinctness of the two birds is indicated by the fact that both apparently belong to the Tropical Zone and that in this zone they occur together as near as Puerto Cabello (sea-level) and Anzoategui (alt. 4750) on the Caribbæan slope, about 100 miles southwest, while *septentrionalis* evidently ranges from the last-named point at least to the Central Magdalena Valley without change.

Mionectes olivaceus pallidus subsp. nov.

Char. subsp.— In general coloration most nearly resembling *M. o. hederaceus* Bangs, but with less yellow in the plumage, the back, therefore, bluer green, the breast streaks whiter, the belly paler.

Type.— No. 122204, Am. Mus. Nat. Hist., ♀ ad., Buena Vista (above Villavicencio, alt. 4500 ft.), March 9, 1913; F. M. Chapman.

Remarks.— This proposed race is based on two specimens for comparison with which I have specimens of all the other described races, including the types of *M. o. olivaceus* and *M. o. venezuelensis.* Although geographically nearest the most highly colored forms of the group (*venezuelensis* and the Santa Martan *galbinus*), *pallidus* is, below, the palest of the five subspecies of *olivaceus,* the breast streaks being whitish, the abdomen sulphur-yellow. The upperparts, however, are darker green than any of the other forms, except *hederaceus,* which it closely resembles in the color of the back, but, as said above, it is here somewhat bluer in tone, while the crown is distinctly darker than the back.

Camptostoma caucæ sp. nov.

Char. sp..— Most nearly resembling *C. pusillum,* but darker above and paler below, the crown with a sooty cap clearly defined from the grayish olive back; the throat and breast gray, quite unlike the sulphur yellow belly.

Type.— No. 112296, Am. Mus. Nat. Hist., ♂ ad., Rio Frio, Cauca Valley (alt. 3500 ft.), December 1, 1911; A. A. Allen and L. E. Miller.

Description of Type.— Upperparts dark grayish olive, the rump somewhat lighter, the entire crown sooty, or chætura black, distinctly different from the back; sides of the head grayish, an inconspicuous whitish eye-ring and loral stripe; tail fuscous, the inner feathers narrowly margined with olive-gray, all the feathers narrowly tipped with whitish, which margins also the terminal portion of the inner web of the outer feathers; wings fuscous, the median and greater coverts tipped with buffy and whitish, forming two bars, the under coverts pale yellowish white; throat and breast gray, merging gradually into a sulphur-yellow belly; feet and bill black; the lower mandible brownish. Wing, 54; tail, 44; tarsus, 19; culmen, 8 mm.

Remarks.— This apparently well-marked species is based on three specimens in addition to the type, one from the type-locality and two from Miraflores on the western slope of the Central Andes above Palmira. It seems to be restricted to the Cauca Valley region where it probably represents *Camptostoma pusillum,* from which, however, it appears to be specifically distinct. A *Camptostoma* from Chicoral, in the upper Magdalena Valley, almost opposite Rio Frio, has the yellowish throat and breast of *pusillum* and the crown is but slightly deeper than the back, the upperparts, however, are darker than in any of the races of *pusillum* and the bird thus shows some approach to *C. caucæ.*

No form of *Camptostoma* has been reported from the Pacific coast of Colombia south of the Atrato River, but the genus reappears on the coast of Ecuador where is found *Camptostoma sclateri,* a pale form with a grayish crown, whitish frontlet, pale rump, comparatively long bill with a yellowish lower mandible and a maximum amount of white in the tail. While presumably representing *C. pusillum, C. sclateri,* of which we have 15 specimens, is evidently specifically distinct from it.

Pitangus sulphuratus caucensis subsp. nov.

Char. subsp.— In the extent of rufous markings most nearly resembling *P. s. rufipennis;* in general color nearer *P. s. sulphuratus.*

Type.— No. 108196, Am. Mus. Nat. Hist., Cali, Cauca Valley, Colombia, Dec. 22, 1910; W. B. Richardson.

Remarks.— Eight specimens from the Cauca Valley (Cali to Rio Frio) show this form to be based on constant and well-marked characters. Compared with nine specimens from the Caribbæan coast region (Santa Marta, Col., San Antonio, Bermudez, Venezuela) which may be considered typically to represent *rufipennis* (type-locality "Caraccas"), the Cauca Valley bird is seen to be much darker above, the color of the upperparts and the fuscous areas in the wings and tail being more as in true *sulphuratus;* there are, however, inconspicuous rufous margins to the feathers which are lacking in true *sulphuratus.* While nearer *rufipennis* in the extent of the rufous markings, *caucensis* shows some return to the *sulphuratus* type even in this respect, the lesser wing-coverts, and particularly the primary coverts and upper tail-coverts, having much larger fuscous shaft streaks, the rectrices and remiges also usually having less rufous, though the differences here cannot be so definitely expressed. In short, occupying a region in which the humidity more nearly resembles that of Trinidad and the Guianas than it does that of the arid coastal zone of northern South America, the characters of *caucensis* in a degree parallel the resemblances in climatic conditions existing between the Cauca Valley and northeastern South America.

With the olive-brown backed *P. s. derbianus* the proposed new form needs no comparison.

Pheugopedius mystacalis amaurogaster subsp. nov.

Char. subsp.— Similar to *P. m. mystacalis* but darker above, the auriculars more solidly black, the submalar stripe broader, the chin and upper throat white but the lower throat and breast washed with ochraceous-tawny, the flanks and abdomen strong ochraceous-tawny, the tail longer.

Type.— No. 122481, Am. Mus. Nat. Hist., ♂ ad., Buena Vista (above Villavicencio), alt. 4500 feet, Eastern Andes, Colombia, March 4, 1913; George K. Cherrie.

Remarks.— Eight specimens of this strongly marked race were collected at Buena Vista where it occurs, doubtless, as a representative of the Subtropical rather than the Tropical Zone, since we did not find it below this point. From a series of 18 specimens of *mystacalis,* including two from near the type-locality, this proposed new form differs constantly and conspicuously, as indicated in the diagnosis.

Two specimens of *Pheugopedius* from Anzoategui, Estado Lara, Venezuela, in the Carnegie Museum, loaned me by Mr. Todd and on which he based his *Pheugopedius macrurus connectens* (Ann. Car. Mus., VIII, 1912, 205), appear to be referable to *Pheugopedius mystacalis consobrinus* (Madar.) from Merida (Ann. Mus. Hung., II, 1904, 115). In color these two birds are much nearer true *mystacalis* than they are to *amaurogaster*. From the former they differ only in having the tail somewhat longer, the crown clearer gray, the back duller. One of these birds has a tinge of buff on the throat and breast, the underparts of the other can be exactly matched in color by specimens of *mystacalis*.

We have in our collection an old 'Bogotá' skin which, while somewhat more richly colored than the birds from Buena Vista, apparently represents the form here described, to which a 'Bogotá' bird commented on by Sharpe (Cat. B. M., VI, 1881, 233) also evidently belongs.

Pheugopedius macrurus (Allen), the type of which is before me, is a most puzzling bird. The skin is of Bogotá make but we found no specimens like it in our work in the Bogotá region, which, however, does not, of course, imply that the bird does not occur there. In general coloration this bird exactly resembles Colombian specimens of *mystacalis* from the Central Andes but the tail differs in color and in pattern from any *Pheugopedius* known to me and the bird is also much larger than any other of the group.

The tail is more strongly graduated than in birds of the *mystacalis* group, but there appears to be so much variation in this respect that the difference noted may be individual. In color it is fuscous, the two outer pairs of feathers are externally margined and longitudinally striped with brownish on the outer vane near the shaft, the succeeding two pairs are faintly and irregularly barred on the outer vane and the central bars become more pronounced, but in no instance do they cross the feather. While there is much variation in the tail-markings of *mystacalis* we have no specimen in which the tail is like that of *macrurus*. Additional specimens may show the type to be non-typical but in the meantime it seems desirable to recognize *Pheugopedius macrurus* as a full species. The large size of the bird's wings as well as tail is indicated in the appended table of measurements.

Measurements of Males.

		Wing	Tail	Tar.	Culmen
P. m. mystacalis	near Huigra, Ecuador,	63	57	25.5	19
P. m. amaurogaster,	Buena Vista, Col.	67	65	26	18.5
" " "	" "	65	64	25	18
" " "	" "	66	68	24.5	19
P. m. consobrinus	Anzoatequi, Ven.	67	67	25	18
P. macrurus (not sexed),	'Bogotá.'	72	72.5	25.5	19

Measurements of Females.

		Wing	Tail	Tar.	Culmen
P. m. mystacalis	Bucay, Ecuador	61	55	24	18.5
P. m. amaurogaster	Buena Vista, Col.	61	58	25.5	18
" " "	" "	61	58	24.5	18
P. m. consobrinus,	Anzoatequi, Ven.	66	61	24	18

Henicorhina leucophrys brunneiceps subsp. nov.

Char. subsp.— Similar to *H. l. guttata* of the Bogotá region, but bill longer and heavier, back and wings much brighter, more ferruginous, the crown always browner; markings on outer margins of primaries less distinct, bars on inner wing feathers and on rectrices wanting or obsolete; the tail more rufescent; breast and throat averaging grayer, the latter more streaked with blackish.

Type.— No. 109913, Am. Mus. Nat. Hist., Gallera (alt. 5700 ft.), Western Andes, Colombia, June 27, 1911; W. B. Richardson.

Remarks.— The occurrence of two forms of *Henicorhina leucophrys* on the western slope of the Western Andes is surprising but is apparently proven by our large series of specimens.

Of *leucophrys guttata,* agreeing in all essentials with Bogotá birds, we have 65 specimens of which 21 were taken in the Western Andes, all in the Suptropical Zone, while of the proposed new form we have seven specimens, chiefly from the lower border of this zone, from the Nóvita Trail to extreme southwestern Colombia, as follows: Nóvita Trail (4000 ft.), 2; Gallera (5700 ft.), 2; Cocal (6000 ft.), 2; Ricaurte (5000 ft.), 1.

Not one of these seven specimens can be matched in color or in the size of the bill in the series of 65 examples of *guttata.* While the latter species usually has the crown washed with brownish, in not one of our specimens is this character so highly developed as in all the specimens of *brunneiceps*, in which, it is important to note, the crown-feathers are, for the greater part, brown to their bases.

To a certain extent, both in regard to distribution and characters, this case appears to parallel that of *Henicorhina inornata* and *H. prostheleuca eucharis.* In both instances we have two forms apparently representative of each other on the Pacific side of the Western Andes, and although *H. inornata* resembles *H. l. eucharis* in having barred wings and tail, it differs from it much as *brunneiceps* does from *guttata,* in having a brown crown and large bill.

Comparative Measurements of Males of *Henicorhina leucophrys*.

	Wing	Tail	Tarsus	Ex. Culmen
H. l. leucophrys (1, Peru)	54	26.5	23	13.5
" " "*berlepschi*" type	53	25.5	23	14
" " *guttata* (1, Minde, Ecuador)	54.5	28.5	23	14
" " " (5, Fusugasugá)	57	29.9	24.5	13.9
" " " (5, San Antonio)	54	28	24	13.5
" " *brunneiceps* (5, Nóvita to Ricaurte)	55.7	27	23.6	16.7

Planesticus caucæ sp. nov.

Char. sp.— Similar to *Planesticus olivater* (Lafr.), but plumage grayer, less suffused with brownish, male with black of the nape even more sharply defined from the gray of the back; breast grayish its upper part lightly streaked with black, sides of the throat black, the center of the throat and chin streaked with black; female with the crown distinctly darker than the back; the underparts much less brown than in *olivater*, the throat with but a trace of black shaft-streaks.

Type.— No. 116938, Am. Mus. Nat. Hist., ♂ ad., testes much enlarged. La Sierra, alt. 6300 ft., Central Andes, Cauca, Colombia, March 1, 1912; A. A. Allen and L. E. Miller.

Adult ♂.— Upperparts olive, more or less tinged with sepia, the entire crown and sides of the head jet black sharply defined from the olive back; wings and tail fuscous, the feathers more or less edged externally with the color of the back; chin white, throat and breast gray, the former with well-defined, the latter with narrow shaft stripes of black; the rest of the underparts grayish wood-brown, more brownish on the flanks; under tail-coverts grayish, narrowly margined with pale wood-brown; under wing-coverts buffy ochraceous; feet brownish; bill bright yellow; upper mandible tipped with blackish. Wing, 119; tail, 94; tarsus, 31; culmen, 23.

Adult ♀.— Resembles the male but the head is more fuscous in color, and but little darker than the back; the throat and breast lack the black marks of the male, but show dull fuscous shaft streaks; the abdomen is nore suffused with wood-brown than in the male; bill duller yellow. Wing, 116; tail, 93; tarsus, 30; culmen, 23.

♂ Immature.— An immature male resembles the adult male but has the back of the head less pronounced and less sharply defined from the back; the throat and breast streaks duller. Wing, 118; tail, 94; tarsus, 31; culmen, 23.

Remarks.— This apparently distinct species is based on four specimens all of which were taken at La Sierra, a locality in the Central Andes, south of Popayan, in heavy forest growth.

Saltator atripennis caniceps subsp. nov.

Char. subsp.— Similar to *S. a. atripennis* but crown largely gray instead of largely black; exposed portions of inner tertials wholly olive-green, throat and breast with no wash of buffy, under tail-coverts paler, bill averaging heavier and more inflated laterally.

Type.— No. 122733, Am. Mus. Nat. Hist., ♂ ad. ("testes much enlarged"), Fusugasugá, alt. 6000 ft., Eastern Andes, Colombia, March 24, 1913; Paul G. Howes.

Remarks.— A series of 20 specimens of *S. a. atripennis* from the Subtropical Zone in the Western and Central Andes bordering the Cauca Valley, includes four topotypes from near Popayan (with which the remaining birds in the series agree), which show that true *atripennis* has the crown wholly black, the inner tertials largely so, the throat with sometimes a faint tinge of buff, and always with a buffy mark at the junction of the white throat and gray breast; the under tail-coverts cinnamon-buff, the maxilla with no marked lateral, bulbous inflation.

Compared with this excellent series, four specimens from Fusugasugá and one 'Bogotá' skin exhibit the characters ascribed to this proposed new form, in which the black of the crown is largely restricted to the forehead and sides of the head, the under tail-coverts are warm buff, the bill shorter and stouter than in *atripennis*, etc.

Two specimens from Gualea, Ecuador, are to be referred to *caniceps* and Hellmayr's (P. Z. S., 1911, p. 1120) comments on two Quito specimens of this species having "somewhat shorter, stouter bill, and the crown dark cineraceous, merely mottled with blackish on the forehead and above the white eye-brow," indicate that they represent the Bogotá form rather than that from Popayan when, if this be true, it is not surprising to find that five specimens from Ricaurte (alt. 5000 ft.), a locality in southwestern Colombia on the Ecuadorian line, are intergrades. The bill in these Ricaurte birds agrees with that of *caniceps*, the color of crown more nearly resembles that of *atripennis* while the tertials are more like those of *caniceps*. The buffy throat mark is barely evident in four specimens and absent in one, but the cinnamon-buff under tail-coverts are unquestionably those of *atripennis*.

The present case furnishes an exception to the rule that the affinities of Ecuadorian forms are with those of the Cauca region rather than with those from Bogotá.

Myospiza cherriei sp. nov.

Char. sp.— Similar to *Myospiza manimbe* but much paler, the plumage with no chestnut, the crown essentially like the back, the breast with no dusky band, the yellow of head more extensive, encircling the eye and basally crossing the forehead, outer primary shorter, equalling the seventh instead of the sixth (from without); outer tail-feathers shorter; bill more slender, the mandible plumbeous rather than brownish in color.

Type.— No. 122770, Am. Mus. Nat. Hist., ♀ ad., Villavicencio (alt. 1600 ft.), llanos at eastern base of Eastern Andes, Colombia, March 12, 1913; George K. Cherrie.

Description of Type.— General color of the upperparts grayish, the feathers of

the crown and back with black shaft-streaks bordered by Saccardo's umber and margined by smoke-gray; a well-developed lemon-chrome superciliary line passing well behind the eye and continued to the nape in smoke-gray, divided from the grayish auricular region by a narrow line of pale Saccardo's umber; forehead basally yellow; tail fuscous, the outer feathers paler than the central ones, the external margins drab; wing-quills fuscous, the outer primaries narrowly margined, medianly, with whitish and all but the outer one margined basally with pale olive-greenish; the inner secondaries and tertials margined with pale wood-brown; greater wing-coverts pale fuscous margined with grayish, the lesser coverts strongly tinged with yellow, the bend of the wing lemon-yellow; underparts silky white, the sides and flanks with a light grayish wash; feet (in skin) pale brownish; maxilla brownish horn color, mandible and tomia plumbeous. Length (skin), 118; wing, 56; tail, longest feather, 45, shortest 40; tarsus, 20.5; culmen, 6.5; depth at anterior margin of nostril, 5.5 mm.

Remarks.— This species is intermediate between *Myospiza manimbe* (Licht.) and *M. aurifrons* (Spix) (= *peruviana* auct.), in fact, it materially closes the gap between these quite unlike forms. In the general coloration of the upperparts it more nearly resembles *manimbe,* but in its strongly graduated tail, white underparts, extent of yellow on the head, color and shape of the bill, it appears to be more nearly related to *aurifrons.* Its wing formula is intermediate in character, the outer primary being shorter than in *manimbe* and longer than in *aurifrons.*

In addition to the type we have a specimen, in juvenal plumage, which on comparison with specimens of *manimbe* and *aurifrons* in corresponding plumage, admirably supports the characters on which *M. cherriei* is based. Both were taken in the fields near Villavicencio, at the eastern base of the Andes.

With unusual pleasure I dedicate this well-marked species to its actual discoverer, Mr. George K. Cherrie, not only in recognition of his services to tropical American ornithology, but also in acknowledgment of his efficiency as a field associate.

Arremonops conirostris inexpectata subsp. nov.

Char. subsp.— Similar to *A. c. conirostris* but wing shorter; in general color of the body resembling *conirostris,* but breast paler and supraloral stripe whiter, wings and tail more nearly like those of *A. c. chrysoma,* the shoulder bright lemon-chrome, the wing-quills, *including the outer primary,* margined externally with yellowish increasing in brightness from within outwardly. Average, three males, wing, 69; tail, 66; one female, wing, 65; tail, 63 mm.

Type.— No. 117120, Am. Mus. Nat. Hist., ♂ ad. Western slope of Eastern Andes below Andalucia (alt. 3000 ft.), June 6, 1912; L. E. Miller.

Remarks.— In view of the stability shown by *Arremonops conirostris conirostris* through a wide area, the appearance of this form so near the type-

locality of that race is surprising and inexplicable. Specimens of *conirostris* from Honda at the western base of the Eastern Andes agree minutely in color and size with others from the eastern base of the same range though these areas are separated by three life-zones making actual contact impossible.

Nevertheless within the same river valley, and in the same faunal area this well-marked race, the characters of which are supported by eight adults and five juvenal specimens, occurs. In no other instance have we found birds common to both Honda and the region west of and below Andalucia to differ geographically from one another, and one is led to believe that possibly *inexpectata* is not strictly a geographical variant of *conirostris*, or at any rate has had its origin from some other source than the Honda region. The bird's resemblance to *chrysoma* of western Ecuador should be considered in this connection, and the apparent isolation of the latter form is also of significance. Obviously it will require closer collecting throughout the country occupied by these birds before we may hope to solve their relationships.

Atlapetes fusco-olivasceus sp. nov.

Char. sp.— In the extreme graduation of the tail and dark olive-green color of the back resembling *Atlapetes flaviceps* Chapm. but differing from that species in being still darker above (approaching in this respect *A. crassus* Bangs).

Type.— No. 117150, Am. Mus. Nat. Hist., ♂ ad., testes much enlarged; San Agustin, alt. 5000 ft., Huila, Colombia; L. E. Miller.

Adult ♂.— Upperparts dark olive green; the crown and sides of the head more blackish and distinctly darker than the back; the rump brighter than the back, the feathers of the loral region basally yellow, the tail strongly graduated, fuscous, narrowly margined with olive green; wings fuscous, the outer margin of the outer primary grayish, the remaining primaries margined with olive green on their basal half, with grayish on the apical half of their outer quills, the inner quills margined externally only with olive; the inner margin of all the wing feathers margined with whitish increasing in extent from without inwardly; underparts rich lemon yellow; the breast to some extent, the sides of the head and flanks strongly washed with olive green. A well-defined, narrow black maxillary stripe; under tail-coverts olive green narrowly margined with olive. Wing, 75; tail, 87, the outer feather 20 millimeters shorter than the longest; tarsus, 23; culmen, 13.

Adult ♀.— Resembles the male, but the grayish outer margins of the primaries are not so evident. Wing, 72; tail, 78; tarsus, 26; culmen, 18.

♂ Immature.— Similar to the adult, but less black above, the crown of essentially the same color as the back; in one specimen the black feathers of the adult are beginning to appear in the crown, in another the feathers of the crown and nape are narrowly tipped with yellowish.

Remarks.— This species is based on three specimens from San Agustin, the type locality, and two from La Palma, a nearby locality of heavy forests in the Central Andes, at an altitude of 5500 feet.

Atlapetes pallidinuchus obscurior subsp. nov.

Char. subsp. — Similar to *A. p. pallidinuchus*, but darker above, dark mouse-gray rather than deep neutral gray; the underparts much more olivaceous, medianly as well as laterally yellowish olive instead of wax-yellow; the rectrices and remiges black instead of fuscous, and without olivaceous margins.

Type.— No. 113269, Am. Mus. Nat. Hist., ♂ ad. Santa Isabel, alt. 12700 ft., Central Andes, Sept. 15, 1911; A. A. Allen and L. E. Miller.

Remarks.— This race has been found only in the Temperate Zone of the Central Andes (Santa Isabel, 7; Laguneta, 2; Almaguer, 4). The characters ascribed to it are shown almost equally well by all the birds in our series, for comparison with which we have six freshly collected, topotypical birds from Fusugasugá.

The olivaceous tone of the underparts (except throat) is particularly marked on the flanks, thighs and under tail-coverts in which the yellow is reduced to a minimum. Above, the differences between the two forms are especially marked on the upper tail-coverts which, in *pallidinuchus*, are, with the back, often washed with olivaceous, whereas in *obscurior* they are nearly black with no trace of olive.

Buarremon sordidus Lawr. (Ann. N. Y. Lyc., X, 1871, p. 138), the type of which is in the American Museum (No. 41062), is a 'Bogotá' skin of *Atlapetes p. pallidinuchus* in juvenal plumage.

Cœreba mexicana caucæ subsp. nov.

Char. subsp.— Similar to *Cœreba mexicana columbiana* (Cab.) but slightly smaller, the superciliaries mixed with grayish, sides of the throat, and sometimes its center, finely barred with grayish. Five males: Wing, 56.5; tail, 33.5; five females, wing, 53; tail, 32.

Type.— No. 109240, Am. Mus. Nat. Hist., ♂ ad. (testes much enlarged), Cali (alt. 3500 ft.), Cauca Valley, Colombia, May 10, 1911; F. M. Chapman and W. B. Richardson.

Remarks.— This unexpected, but apparently quite distinct form is based on eleven adults from the Cauca Valley and Subtropical Zone of the Western Andes, while an immature bird from Miraflores, in the mountains on the eastern side of the Valley, is doubtless also to be referred to it. The unusual characters in adults of this group, of a grayish superciliary line and barred sides of the throat, are present in all our specimens. At first glance these markings suggest immaturity, but the birds showing them are unquestionably fully adult.

Five specimens from Tumaco, Buenavista and Ricaurte agree essentially with six from Esmeraldas, Rio de Oro, Naranjo and Gualea in Western

Ecuador. They are smaller than *columbiana* and average deeper yellow below and more olivaceous on the flanks, but in the color of the upperparts and rump I can distinguish no difference.

Salvadori and Festa (Bull. Mus. Torino, XV, 357, 1899, p. 13) refer birds from western Ecuador to *columbiana* and describe the bird from southeastern Ecuador (Zamora, Gualquiza) as *Certhiola intermedia.* Lowe (Ibis, 1912, p. 502) refers all Ecuador specimens to *intermedia* including skins from Gualquiza, Zamora, Esmeraldas, etc. In the absence of topotypical specimens of *intermedia* I can venture no opinion as to which of these views is correct.

A bird recorded by Hellmayr (P. Z. S., 1911, p. 1098) from Pueblo Rico (alt. 5200 ft.) on the western slope of the Western Andes and in the same zone as Lomitas, whence we have two specimens of *caucæ,* may prove to be that form.

Lowe (Ibis, 1912, p. 501) records two specimens of "*luteola*" from "Juntas" (Western Colombia). If the locality be correct could these not be 'accidental visitants' of *gorgonæ* from the not distant Gorgona Island?

Cali, 7; Rio Frio, 1; San Antonio, 1; Las Lomitas, 2; Miraflores (?), 1.

Tangara guttata tolimæ subsp. nov.

Char. subsp.— Similar to *T. g. eusticta* Todd, but upperparts darker and less spotted, the yellow of the head more restricted, as in *T. g. bogotensis* Hellm. & Seil.

Type.— No. 95087, Am. Mus. Nat. Hist., ♂ ad., about 20 miles west of Honda, Tolima, Colombia, February 20, 1907; Mrs. E. L. Kerr.

Remarks.— This interesting connecting form between *T. g. bogotensis* and *T. g. eusticta* of Costa Rica is based on two specimens both from the Central Andes west of Honda.

In the heavy spotting of the throat and breast it agrees with *eusticta,* of which Mr. W. E. Clyde Todd has loaned me seven Costa Rican specimens; in its green auriculars and subocular region and yellowish green supraloral stripe and orbital ring it agrees with *bogotensis;* in the color of the back it is fairly intermediate between the two; while in the markings of the back it practically agrees with *bogotensis.* With the more eastern forms of the group it requires no comparison. Specimens from Ecuador are not available, but if Bonaparte's *Calliste guttulata,* from Mindos, northwestern Ecuador (Compte Rendu, XXXII, 1851, p. 76) is based on a representative of *Tangara guttata* his description "et cette couleur jaune teint aussi fortement la tete" applies to the Costa Rica bird rather than to the one here described.

Tangara aurulenta occidentalis subsp. nov.

Char. subsp.— Similar to *T. a. aurulenta* but underparts more richly colored, approaching raw sienna rather than analine-yellow, under tail-coverts, particularly, deeper; the crown and rump slightly more intense, the margins to the feathers of the back and, especially secondaries and wing-coverts, similar to color of head, and, in adult specimens, without the tinge of green present in *aurulenta;* the bill averaging longer.

Type.— No. 108522, Am. Mus. Nat. Hist., ♂ ad., San Antonio, alt. 6600 ft., Cauca, Colombia, Feb. 1, 1911; W. B. Richardson.

Remarks.— The characters above assigned to this proposed new form are well shown by 21 specimens from the Western Andes (Las Lomitas, San Antonio, Cocal, Gallera) when compared with eight specimens from Fusugasugá and El Roble which I assume typically represent *T. a. aurulenta* (described from 'Bogotá').

Tangara aurulenta goodsoni, recently described from Gualea, Ecuador, by Hartert (Bull. B. O. C., XXXIII, Dec. 23, 1913. p. 78), is intermediate between *aurulenta* and *occidentalis,* but is nearer the former. On comparison of the specimens of true *aurulenta* just mentioned, with nine of *goodsoni* from Ecuador, including five from Gualea, the type-locality, I can detect practically no difference in the color of the head, rump and underparts; but in the more golden, less greenish tinge of the margins of the feathers of the back and wings, particularly of the greater coverts, and size of the bill, *goodsoni* is more like *occidentalis.* The feathers of the back, however, appear to be more widely margined, as a rule, in *goodsoni* than in either *aurulenta* or *occidentalis,* and the back areas, therefore, average smaller in the Ecuadorian than in either of the Colombian forms. From *goodsoni* as well as from *aurulenta, occidentalis* may be distinguished by the deeper coloration of the rump, head and underparts, particularly ventral region and under tail-coverts, and from *goodsoni* by the greater amount of black in the feathers of the back. A specimen from Miraflores in the Central Andes agrees minutely with those from the Western Andes across the Cauca Valley; but six specimens from Ricaurte near the Ecuador boundary, in their paler coloration closely approach *goodsoni.*

Tangara florida auriceps sp. nov.

Char. subsp.— Similar to *T. f. florida* Scl. & Salv. but smaller (size of *T. f. arcæi*), yellow of head of much greater extent, reaching to the forehead; black of loral region and about base of bill wider, scapulars black without, or with but slight greenish borders. ♂, wing, 65; tail, 40; tarsus, 15; culmen, 9.5. ♀, wing, 62; tail, 40; tarsus, 15; culmen, 9.5.

Type.— No. 118247, Am. Mus. Nat. Hist., ♂ ad., Buenavista, alt. 1200 ft., Dept. Nariño, S. W. Colombia, Sept. 30, 1912; W. B. Richardson.

Remarks.— Of this race we have four adult males, three adult females and one unsexed immature specimen, all from the type-locality. The females may be distinguished from females of *arcœi* by their usually brighter rump and crown.

An immature female from Nóvita, on the San Juan River, though probably *auriceps,* cannot with certainty be referred to either form. It indicates, however, the continuous range of this species through the humid Tropical Zone of the Pacific Coast and the consequent intergradation of *auriceps* with *arcœi.* Nevertheless, *auriceps* most nearly resembles in color the form (*T. f. florida*) from which it is geographically most widely separated.

Chlorospingus flavigularis marginatus subsp. nov.

Char. subsp.— Similar to *Chlorospingus flavigularis hypophœus* but breast and sides light olive-gray rather than buffy brown, back greener; resembling *C. f. flavigularis* Scl., but wings and tail shorter, breast and sides browner, flanks more olivaceous, lores grayer, wing-quills margined internally with buff increasing in amount from without inwardly.

Type.— No. 118333, Am. Mus. Nat. Hist., ♂ ad., Buenavista (alt. 1200 ft.), Dept. Nariño, S. W. Colombia, Sept. 27, 1912, W. B. Richardson.

Remarks.— This race is based on comparison of 5 specimens from the type-locality, one from Ricaurte and one from Cocal, with 4 topotypical specimens from Buena Vista and Monteredondo, above Villavicencio in the Bogotá region, and one topotypical specimen of *hypophœus.* True *flavigularis* has the underparts, from the throat downward, nearly uniform gray, the sides being little if any darker than the breast, and the centre of the abdomen little if any lighter, the inner margins of the wing-quills essentially of the same color as the inner webs of the feathers, while in *marginatus* the breast has a faint buffy wash, the sides are brownish, the flanks olivaceous, the center of the abdomen pronouncedly whiter than the rest of the underparts, the wing-quills internally margined with buffy forming a conspicuous border on the webs of the inner feathers. This latter character is also found in *C. f. hypophœus* of Veragua suggesting, as the distributional facts would also indicate, that *marginatus* is more nearly related to *hypophœus* than to *flavigularis.* It, however, in part bridges the difference between them, and the gap is further filled by three specimens from La Palma and Andalucia at the head of the Magdalena Valley, in which the underparts more nearly approach those of *marginatus* but the wings agree with those of *flavigularis;* all have the throat orange instead of canary-yellow, but this feature appears to be either individual or due to age; since it appears also in a bird from

the Bogotá region. It should be added that in specimens having the throat orange, the lores are olive.

'Napo' birds show a suggestion of the fulvous edging to the wing-quills but should evidently be referred to true *flavigularis.*

It is worthy of note that no form of this group has been recorded from the region between southwestern Colombia and Veragua. The distribution of the group therefore is, in this respect, not unlike that of *Arremonops conirostris.*

Measurements.

	Wing	Tail	Culmen
C. f. marginatus, 3 males	73.5	55.5	8.5 mm.
C. f. flavigularis, 3 "	80.3	62	8.3
C. f. hypophæus, 1 "	73	51	8.5
C. f. marginatus 3 females	71	55	8.5
C. f. flavigularis 1 "	76	61	8.5

Ostinops sincipitalis neglectus subsp. nov.

Char. subsp.— Similar to *Ostinops sincipitalis sincipitalis,* but back more olivaceous and much less brownish; the yellow frontal band narrower, and not continued backward in superciliary stripes.

Type.— No. 123115, Monteredondo, eastern slope of Eastern Andes, alt. 5800 ft., ♂ ad., March 1, 1913; T. M. Ring.

Remarks.— Our collections show that two forms of this species occur in the Subtropical Zone of the Eastern Andes; one on the eastern slope, and one on the western; they may be easily distinguished in color, the west slope form having the back more heavily washed with brown (varying from Sudan brown in the female to Argus brown in the male, in both margined with olive-yellow), and the yellow of the forehead broader and extending backward in well-defined superciliary lines. Cabanis's name, *sincipitalis,* is evidently based on this west slope form, to which his description "Er hat gelben Vorderkopf und Superciliarstreifen," clearly applies. Our three specimens of *sincipitalis* are all from Fusugasugá. Of the form inhabiting the Subtropical Zone of the eastern slope we have in addition to the type, an adult male and female from the eastern slope below Andalucia (5000 ft.) and an adult male from near Merida (alt. 6000 ft.), Venezuela. In the Andalucia specimens the yellow frontlet is reduced to a narrow line. In the Merida example it is wider and more nearly approaches the condition shown by true *sincipitalis,* but the back is less brown than in that form. The status of the Merida bird cannot, however, be determined without further material.

Agelaius icterocephalus bogotensis subsp. nov.

Char. subsp.— Resembling *A. i. icterocephalus* but larger, the male similarly colored, the female much darker, the head with less yellow, the back less distinctly streaked, the margins to the feathers grayer, less yellow; the flanks and abdominal region much grayer.

Type.— No. 123126, Am. Mus. Nat. Hist., ♀ ad., Suba Marshes, Bogotá Savanna, Colombia; February 21, 1913; F. M. Chapman.

Measurements.

	Wing	Tail	Tarsus	Culmen
A. i. bogotensis ♂ [1]	92	73	26.5	20 mm.
" " " ♀ [1]	79	65	24	18
A. i. icterocephalus ♂ [2]	85	67	26	19
" " " ♀ [3]	72	59	23	17.5

Remarks.— It was somewhat surprising to find this Tropical Zone species a common inhabitant of the lagoons on the Bogotá Savanna, and hence in the Temperate Zone, where it is apparently isolated from the ancestral form. A representative series contains seven males and nine females all of which exhibit the characters on which the subspecies is based; the females all being as dark as the immature male of *icterocephalus,* but with less yellow.

Of true *icterocephalus,* we have twenty-three specimens including seven females and a pair of birds from 'Guiana' which may be considered as typical. It is interesting to discover among our specimens two which are unmistakably *icterocephalus icterocephalus* though both are labeled 'Bogotá.' Doubtless they were secured in lowlands at the base of the Eastern Andes.

Icterus hondæ sp. nov.

Char. sp.— Wings, tail, throat and capistrum black, unmarked as in *Icterus giraudi,* orange areas as deeply colored as in *Icterus auratus,* with which it agrees in size.

Type.— No. 123163, Am. Mus. Nat. Hist., ♂ ad., Honda, alt. 600 ft., Magdalena River, Colombia, February 3, 1913; G. M. O'Connell.

Description of Type.— Forehead, lores, cheeks and interior part of auriculars black, sprinkled with a few yellowish feathers of the preceding (immature) plumage; wings black, all but the outer primary narrowly margined externally on the apical half with grayish, the secondaries similarly margined with olive gray; the tertials

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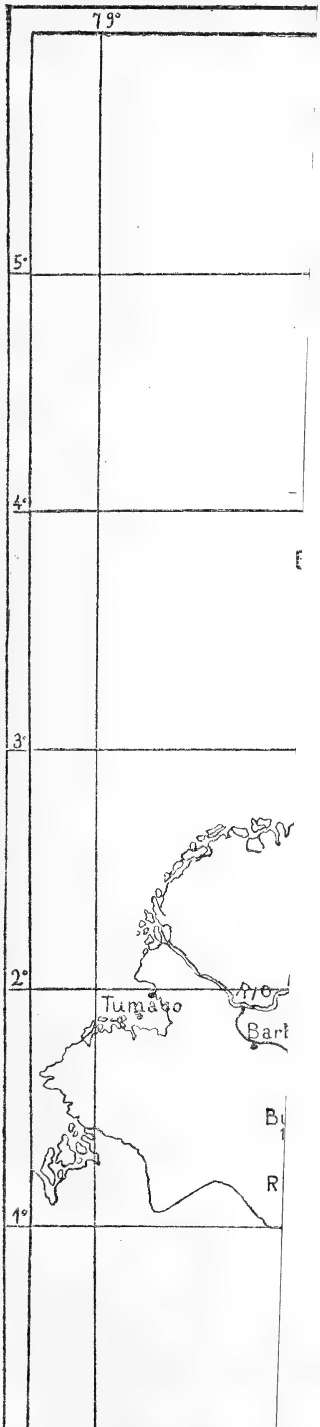
[1] Average five specimens.
[2] Two males, Trinidad and Guiana.
[3] Two females, East Venezuela and Guiana.

margined with orange; the lesser wing-coverts (narrowly) and under wing-coverts lemon-yellow; tail evenly graduated, black to extreme base from above, slightly yellowish at base of inner vanes from below, the outer pair of feathers with yellow shafts and slightly margined and marked near the shaft with olive-yellow; yellow on shafts decreasing inwardly and appearing only near end of feather; rest of plumage orange, in places cadmium orange; lemon-yellow showing to some extent on the side and scapulars. Wing, 90; tail, middle feather, 92, outer feather, 66; tarsus, 25.5; culmen, 24.

Remarks.— Two males of this Oriole taken at Honda agree closely, and both show enough traces of the preceding plumage to indicate that they are in first nuptial dress. In richness of color both agree with highly plumaged specimens of *Icterus auratus,* a condition which is not approached by a single example in our series of over 60 specimens of *Icterus giraudi* taken throughout its range. Nevertheless *hondæ* is clearly most closely related to *giraudi,* too closely one might imagine for them both to breed in the same area. It is important to note therefore that while we have found *giraudi* to be widely distributed in Colombia it is there a bird of the Subtropical Zone which we have rarely found below an altitude of 3000 ft. Consequently if *hondæ* be a representative of *giraudi* their apparent distribution in the same area may be explained by their occurrence in different zones, *hondæ* inhabiting the Tropical, *giraudi* the Subtropical Zone.



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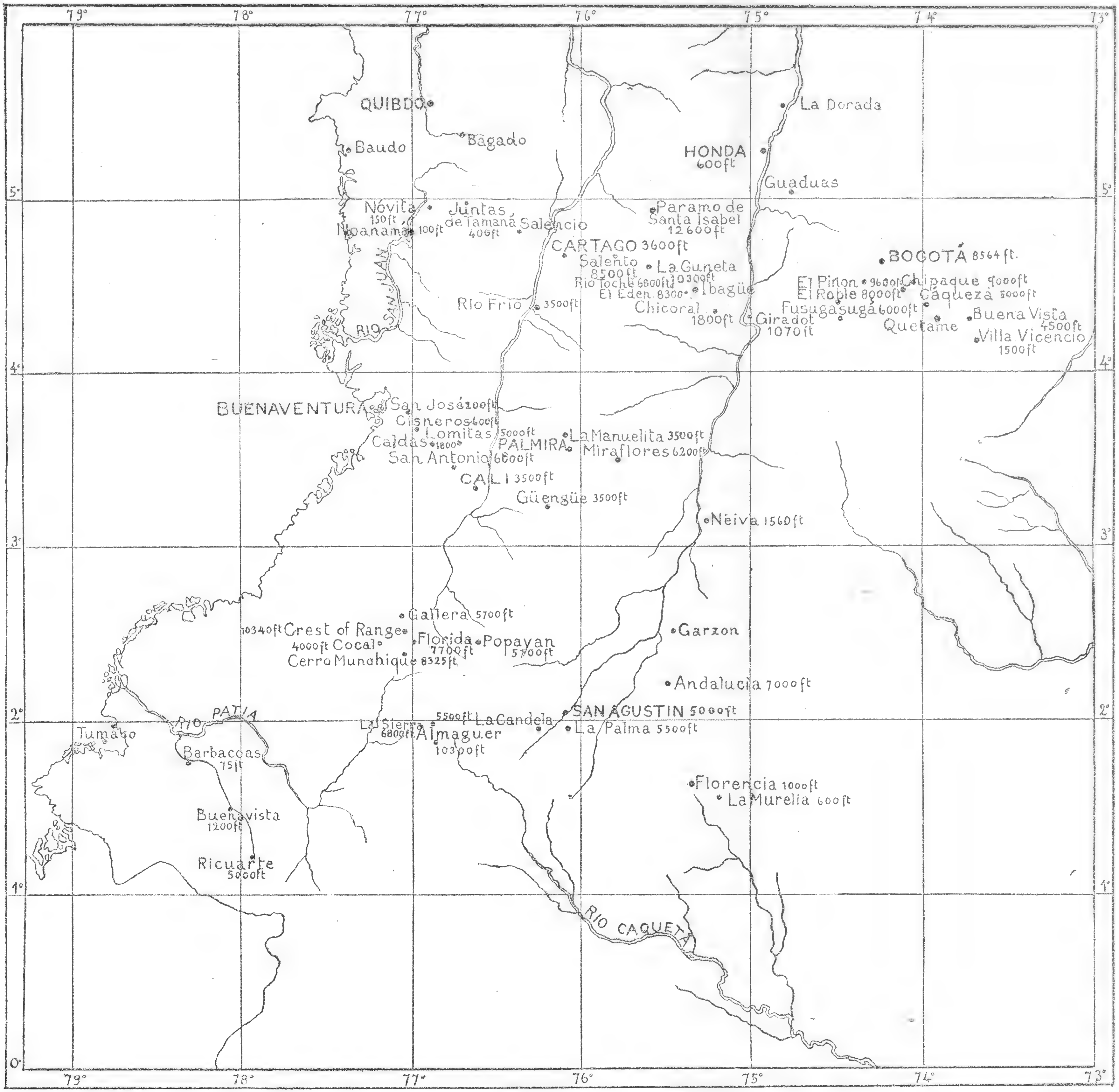

SKETCH-MAP OF SOUTHWESTERN COLOMBIA SHOWING LOCALITIES VISITED BY AMERICAN MUSEUM EXPEDITIONS.

59.82(87)

Article XIII.—DESCRIPTIONS OF A NEW GENUS AND SPECIES OF BIRDS FROM VENEZUELA.

By Frank M. Chapman.

The mountainous region at the headwaters of the Orinoco is, zoölogically, one of the least known areas in South America. Various attempts have been made to penetrate it but the obstacles presented by climate and transportation have not been wholly overcome.

Mr. L. E. Miller, who recently headed an American Museum expedition to this *terra incognita,* has more nearly achieved success than any of his predecessors, but through no fault of his he was obliged to retreat just as he was about to reap the reward of two months' constant exertion and exposure to the dangers incident to travel on the Orinoco.

Mr. Miller, accompanied by Mr. F. X. Iglseder, as assistant and cartographer, left Ciudad Bolivar, on December 17, 1912, in a small sloop bound for San Fernando de Atabapo. After a number of narrow escapes and the loss of one man, this remote settlement was reached January 28. On February 3, he re-embarked with a mandioca-hunter, whom he was fortunate enough to encounter, for his destination, Mt. Duida, farther up the Orinoco. This mountain being unscalable from the Orinoco side (site of the now abandoned village of Esmeraldas), it was proposed to attack it from the west by ascending the Cunucunuma, a small river which flows into the Orinoco about 20 miles west of the junction of the Orinoco and Cassiquiare, and on March 4, camp was established at Boca Sina, some 8 miles from the mouth of the Cunucunuma, and but two miles from the base of Duida.

Work was now begun on a trail through the forest to the mountain, but before it was completed Mr. Iglseder fell desperately ill with a complication of beri-beri and malaria, and in order to save his life Mr. Miller was compelled to return with him to San Fernando and, eventually, to the coast of the Paria Peninsula at Cristobal Colon.

Some 400 birds were collected on the Upper Orinoco; but none were taken above an altitude of 700 feet at the base of Duida, and the fauna of the mountain still remains unknown.

The six hundred specimens secured at Cristobal Colon represent a surprising number of species not found in Trinidad. An annotated list will be published later; in the meantime the more striking novelties of both collections are herewith described.

The color terms employed will be found figured in Ridgway's 'Color Standards and Nomenclature,' Washington, 1912.

Geotrygon pariæ sp. nov.

Char. sp.— Similar to *Geotrygon venezuelensis* but darker throughout; nape with little or no gray, foreback washed with greenish or purplish; wings, etc. olive-brown rather than bay.

Type.— No. 120271, Am. Mus. Nat. Hist., ♀ ad., Cristobal Colon, Paria Peninsula, Venezuela, alt. 1500 ft., June 1, 1913; L. E. Miller and F. X. Iglseder.

Description of Type.— Forehead light vinaceous-tawny, the cheeks and auriculars paler passing into iridescent vinaceous-brown on the crown and nape; a narrow loral stripe and broader submalar stripe black; post-ocular patch deep gull-gray; back olive-brown, the anterior portion iridescent purplish green, becoming purer purple on the posterior margin of the iridescent area; tail more ruddy than black, approaching Vandyke brown; wing-quills fuscous, externally sepia, the coverts browner, more russet in tone; under wing-coverts cinnamon; chin and throat white, chest gull-gray, narrowly tipped with pale cinnamon; flanks, thigh and under tail-coverts cinnamon-brown, paler, more buffy on the center of the breast and belly; feet coral, bill black. Wing, 143; tail, 106; tarsus, 39; culmen, 14 mm.

Remarks.— This species is represented by two specimens. It is doubtless the representative of *G.venezuelensis* and may be found to intergrade with that form, but comparison with three Merida specimens (topotypes) appears to indicate its specific distinctness. Probably it is more closely related to the Tobagan form to which Salvadori (Cat. Bds. B. M., XXI, p. 58) refers.

Neomorphus nigrogularis sp. nov.

Char. sp.— Similar to *Neomorphus rufipennis* (Gray), but smaller, the throat blackish, the lower breast, bill and flanks much darker; tail and wing-coverts greener.

Type.— No. 120273, Am. Mus. Nat. Hist., ♂ ad., "testes enlarged." Foot of Mt. Duida, alt. 700 ft., Venezuela, March 28, 1913; L. E. Miller.

Description of Type.— Crown, nape and foreback shining, blackish blue, changing into olive-green on the middle-back which in turn becomes more bronzy on the rump and upper tail-coverts; tail externally olive-green with purplish reflections and a broad but ill-defined tip of indulin blue; primaries purplish black; secondaries brighter and widely margined externally with ferruginous chestnut; ocular region bare, the skin dull scarlet; cheeks, auriculars, chin and throat dark mouse-gray, the upper throat narrowly, the lower, more broadly tipped with shiny black becoming solid dark bluish black on the upper breast and sides of the neck; lower breast and abdomen deep mouse-gray becoming darker on the sides and deeper, more sooty, on the flanks and crissum; thighs mouse-gray; bill blackish basally, horn-color apically,

but the colors not sharply defined; maxilla yellowish basally. Wing, 151; tail 10.5, tarsus, 71; bill from posterior end of nostril, length, 38, depth, 12; gonys, 17 mm.

Remarks.— Of this form we have but a single specimen and of *N. rufipennis* an adult male and female, collected by Klages at Suapure, near the mouth of the Caura River, Venezuela, the latter agreeing well in essential details with the colored figure of Gould's type (P. Z. S., 1849, pl. 10). In view of the comparatively short distance between Suapure and the country at the foot of Duida it is somewhat surprising to find so old and apparently stable a type as *Neomorphus* represented at each locality by a different form. It may be suggested therefore that the differences exhibited by the Duida specimen are due to immaturity. The bird, however, appears to be adult and the collector's comment of "testes enlarged" indicates that it was at least sexually mature.

On the other hand, the differences shown may indicate the isolation of the Duida region and consequent specialization of some of the forms resident in it.

Nonnula duidæ sp. nov.

Char. sp.— Similar to *Nonnula cineracea* Scl., but lores, chin, throat and breast ochraceous tawny.

Type.— No. 120174, Am. Mus. Nat. Hist., ♂ ad. (testes slightly enlarged). Foot of Duida, alt. 700 ft., Venezuela, March 28, 1913; L. E. Miller.

Description of Type.— Upperparts rich olive-brown, the crown slightly grayer, the forehead faintly tinged with cinnamon, becoming ochraceous tawny on the lores and base of the maxilla laterally; eye-ring whitish tinged with cinnamon, auriculars darker than auricular region, nearly the color of the back; tail, from above, blackish, the outer feathers lighter and with ill-defined grayish tips; from below, grayish, the central feathers with obscure blackish centers apically; wings fuscous, very narrowly bordered with buff externally, the inner margins of all but the outer primary and tertials margined with ochraceous-buff increasing in extent inwardly and coloring the under wing-coverts; chin, throat and breast ochraceous-tawny, lengthened bristly feathers of the former tipped with black; flanks paler, abdomen and under tail-coverts white, feet brownish; bill blackish, gonys yellowish. Wing, 64; tail, 52; tarsus, 13.5; culmen, 23.5 mm.

Remarks.— The collection contains a single specimen of this new form which considerably extends the range of the genus in the Amazon region. Doubtless it represents *Nonnula cineracea* with which it may be found to intergrade.

Microxenops gen. nov.

Char. gen.— Most nearly resembling *Xenops*, but gonys straight, not recurved, tail of ten instead of twelve feathers, square instead of rounded, and not reaching beyond the closed wings.

Description of Type.— A small, furnariine climbing bird, with a short, rather stout, laterally compressed bill, the depth at anterior border of nostril more than one-third greater than the width at the same place; gonydeal angle but slightly pronounced, the gonys straight; culmen slightly convex, the maxilla unnotched; comissure straight; nostril opening through a narrow, elliptical slit; second, third and fourth primaries of equal length, the fifth slightly shorter, the first and sixth subequal (all counted from without inward); tail of ten feathers, short, in skin not reaching beyond longest primaries in closed wing; the feathers rounded, all of about equal length and width; feet essentially as in *Xenops* but more slender, the toes joined basally, the inner to middle by its basal phalanx, the outer to middle by slightly more; hind-toe and claw longer than middle toe and claw; outer toe and claw reaching beyond, the inner toe and claw not reaching to the base of middle-toe without claw; tarsus scutellate, about equal in length to middle-toe and claw. Type, *Microxenops milleri*.

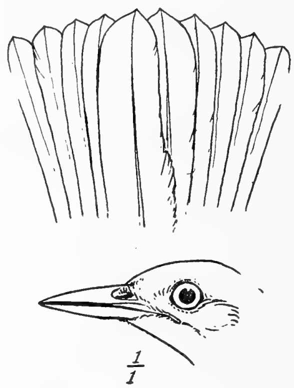

Fig. 1. Tail and bill of *Microxenops*.

Microxenops milleri sp. nov.

Char. sp.— A small (length skin, 96 mm.) furnariine bird with a general resemblance in color to species of the genus *Xenops* but with no white subauricular stripe and no black in the tail.

Type.— No. 120275, Am. Mus. Nat. Hist. ♀ ad. Foot of Mt. Duida, alt. 700 ft., Venezuela, April 7, 1913; L. E. Miller.

Description of Type.— Crown blackish, conspicuously and evenly streaked from bill to nape with maize-yellow; a poorly defined maize-yellow superciliary stripe; interscapulars raw-umber with an olivaceous tinge, broadly striped with cream-color, deeper in tone terminally; rump cinnamon-rufous, unmarked; upper tail-coverts and tail deeper, more ferruginous; wing-quills black, the outer primary unmarked, the inner web of the second (from without) primary narrowly margined with ochraceous-buff, this color increasing in extent inwardly and forming a broad bar through the wing from the sixth primary (from without) inward, this bar on the outer vane of this feather being deeper cinnamon-rufous, the tertials largely cinnamon-rufous with an apical black shaft-streak; inner secondaries margined externally with cinnamon-rufous; greater wing-coverts black margined apically and externally with tawny olive; lesser wing-coverts black tipped with buff; under wing-coverts light ochraceous buff; throat, breast and cheeks cream-color laterally, margined with olive; flanks

and under tail-coverts grayish olive, the former obscurely streaked with cream-color, the latter more strongly marked with cream-buff; feet brownish black; toe-nails horn-color; bill black; lower mandible horn-color, its base blackish. Length (skin), 96; wing, 61; tail, 32; tarsus, 15.5; middle-toe and claw, 15; hind-toe and claw, 16; culmen, 12; bill at anterior margin of nostril, depth 4, width, 2.7 mm.

Remarks.— This interesting and apparently very distinct form is represented by but one specimen. Doubtless it resembles *Xenops* in habits, as it does in general appearance, but the marked difference in their structure suggests that the resemblance is superficial rather than indicative of close relationship. In its short, square tail *Microxenops* suggests *Sitta,* while the short wedge-shaped bill recalls, at first glance, that of *Picumnus* rather than that of any known genus of Furnariidæ or Dendrocolaptidæ.

I have named this species in honor of its collector, Mr. Leo E. Miller, in recognition of his services to science and to the American Museum as the leader of the expedition on which it was secured.

59.9,32 (86.6)

Article XIV.— TWO NEW MAMMALS FROM ECUADOR.

By J. A. Allen.

Sylvilagus daulensis sp. nov.

Type, No. 34671, ♀ ad., Daule (near sea-level), Guayas, Ecuador, April 21, 1913; Wm. B. Richardson.

Pelage rather coarse and harsh, with very little underfur. Prevailing color of the back black, the hairs being black for the basal half, then broadly ringed with fulvous, and with long black tips; flanks pale buff, the hairs with short, inconspicuous black tips; top of head rufous, the hairs slightly tipped with black over the median area, and with long black tips laterally, next to the broad buffy superciliary stripe; hairs below the eyes heavily tipped with black, the cheeks buffy; nuchal patch large, deep rufous; shoulders and thighs yellowish rufous; fore and hind feet whitish buff; pectoral band very broad, the hairs plumbeous at the base, the dark portion wholly concealed by the deep buff apical half, the extreme tips of the hairs blackish; belly clear white, the pelage short and woolly; sides of nose, chin, and throat white; inside of fore and hind limbs white to the feet; ears pale rusty brown, well clothed with short hairs externally, nearly naked internally.

Total length (type and only specimen), 350 mm.; ear, 53; hind foot (in dry skin with claws), 72. Skull, occipitonasal length, 69; greatest breadth, 31.5; interorbital breadth, 16; breadth of occipital shelf, 7; diastema, 18; palatal foramina, 17; antero-posterior diameter of bulla, 9; length of palatal bridge, 6.2; premolar-molar series at base, 13.

Sylvilagus daulensis is similar in general appearance to *Sylvilagus surdaster* Thomas, but smaller in both external and cranial measurements and quite different in several details of coloration. *S. daulensis* has a conspicuous broad, buff superciliary stripe, while *S. surdaster* is described as having "no prominent light or dark orbital or cheek-markings"; the basal portion of the dorsal pelage is black or blackish, not "light grey"; the ears are longer and externally light rusty brown, not "grizzled rufous, just at their bases, but otherwise nearly wholly black"; the back is obviously much blacker, and the pectoral band quite different. The type locality of *surdaster* is Carondelet, in the humid coast region of northwestern Ecuador; the type locality of *daulensis* is the arid coast region bordering the Gulf of Guayaquil in the Province of Guayas, in a very different faunal district.

Thomasomys aureus altorum subsp. nov.

Type, No. 36280, ♂ ad., Mt. Pichincha (altitude 11,000 ft.), Ecuador, June 15, 1913; coll. Wm. B. Richardson.

Similar to *R. aureus* but much paler and yellower above and paler below, with the claws white to the base instead of dark brown as in *aureus*, and tail shorter, more hairy and much more heavily pencilled; skull larger and heavier than in *aureus*, with the superorbital edges heavier, forming a raised but not projecting border; dentition much heavier, in correlation with the greater size of the skull.

Total length (type), 360; head and body, 160; tail vertebræ, 200; hind foot, 34. Another young adult male is slightly larger, as follows: total length, 400; head and body, 185; tail vertebræ, 215; hind foot, 35.

Skull (type), total length, 40.5; zygomatic breadth, 20.4; interorbital breadth, 5; breadth of braincase, 16; length of nasals, 14.8; length of palatal foramina, 10; length of upper toothrow, 7; diastema, 10.1. The other skull is imperfect.

The locality of the type of *R. aureus* is not stated but has been considered to be Pallatanga, and it seems proper to assume Pallatanga as the type locality of the species. It is in the forest region at about 7000 feet, whereas the type locality of *R. aureus altorum* is the paramo of Mount Pichincha. A specimen from Gualea, now before me, may probably be regarded as typical of *aureus*.

55.1.781(78.7)

Article XV.— ON THE NAMES OF LOWER EOCENE FAUNAL HORIZONS OF WYOMING AND NEW MEXICO.

By Walter Granger.

The writer has been engaged for the past five years in the exploration, for the American Museum, of the Lower Eocene of Wyoming and New Mexico. A large collection of fossil mammals has been brought together, and important stratigraphic studies have been made, principally by Dr. Wm. J. Sinclair who has accompanied three of the expeditions. A systematic study of the collection, now well under way, by Dr. W. D. Matthew, Dr. Sinclair, and the writer, has shown the existence of a greater number of distinct faunal horizons in these regions than was previously known to have existed. Some of these horizons have already been defined and named by Sinclair and Granger in two articles in this Bulletin[1] and the object of the present article is to make certain corrections and to establish four new horizon names, two for the Bighorn region and two for New Mexico. Geographical names are used because they are the most satisfactory. The use of generic names for the purpose of defining mammal horizons often leads to confusion and, except in conjunction with geographic names, should be discontinued. For instance, the name *Coryphodon Zone* has been used for a certain horizon of the Bighorn deposits, yet the genus occurs in more or less abundance throughout the entire Lower Eocene. In some cases horizons can be, and are, determined by the range of a certain genus but there are other horizons which possess no characteristic genus, or at least none common enough to serve the purpose of defining and outlining the zone. The possibility of a generic name being relegated to synonymy is another argument against its use for this purpose.[2]

Wyoming.

Previous to 1904 the mammal-bearing Tertiary of the Bighorn basin was considered as one formation and one faunal horizon. Collections from upper 15 Mile Creek, an area known as Buffalo basin, seemed to represent

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[1] Bull. Amer. Mus. Nat. Hist., Vol. XXX, 1911, art. vii; Vol. XXXI, 1912, art. v.

[2] *Note.*— Geologic levels can no longer be correlated merely by *generic* names, we are subdividing the strata so finely. They can still be distinguished by *generic and specific* names. The day will probably come when trinomials will be necessary. Abandonment of faunal names for the Life Zones would be a step backward. H. F. O.

a somewhat younger fauna than that from the Gray Bull valley but still it lacked all of the characteristic forms of the later Wind River fauna. In 1904 Dr. F. B. Loomis, of Amherst College, conducted explorations in the Bighorn basin and succeeded in obtaining specimens of the Wind River genus *Lambdotherium* from the upper levels at the western end of Tatman Mountain, and he concluded from that that the upper 1000 feet of the Bighorn sediments overlapped in time the base of the Wind River.[1]

The work of the American Museum expeditions in the Wind River basin in 1905, 1909 and 1910 resulted in the discovery that there were two very distinct Lower Eocene faunal horizons there and they were given separate names by Sinclair and Granger.[2] The upper beds containing *Lambdotherium* and *Eotitanops* were named the Lost Cabin formation and the lower beds, from which these two genera were absent, the Lysite formation. The Wind River collection of Cope and of the early expeditions from this museum were all from the upper horizon and the name "Wind River" as previously used, with reference to the fauna, is equivalent to Lost Cabin.

Continuing work in the Bighorn basin in 1910 and 1911 the American Museum party made a considerable collection in the *Lambdotherium* level of Dr. Loomis, sufficient to establish beyond much doubt that this horizon is the exact equivalent of a portion, at least, of the Lost Cabin. The thickness of these beds in the Bighorn basin is 325 feet and in the type locality about 400 feet.

Below the Lost Cabin beds of the Bighorn basin are some 500 feet of deposits which were referred to the Lysite. The principal exposures of the series of strata are in the upper part of Buffalo basin to the south of Tatman Mountain and along the northern base of the Mountain in the Gray Bull Valley, between Fenton and Coyote Canon. A large collection has been obtained from these beds and the analysis of the fauna shows that the reference to the Lysite was a correct one.

Lying exposed along the Gray Bull River between the base of the Lysite and what has been mapped by Fisher as "Laramie and associated formations," probably in part Fort Union, is another series of 600 feet or more of highly fossiliferous beds. The beds are exposed chiefly along the south side of the river from a little above Fenton to just below the mouth of Dorsey Creek and are most extensive in the vicinity of Otto. This is the horizon and locality of the larger part of the Lower Eocene collections from the Bighorn basin including the two *Phenacodus* skeletons of the Cope collection and the *Coryphodon, Oxyæna,* and *Eohippus* skeletons of later

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[1] Am. Jour. Sci., XXIII, 1907, p. 363.
[2] Loc. cit., 1911, p. 104.

collecting. Lithologically, the beds cannot be separated from the overlying Lysite but the faunal distinctions are sufficient to warrant such a separation. It is the horizon of the genus *Systemodon*, one of the commonest forms, and marks the limits of this genus. In the Lysite *Systemodon* is replaced by *Heptodon*. It was the presence or absence of these genera which determined in the field the line of separation between the Lysite and the underlying beds.

As mentioned above the name Wasatch has been commonly used for the whole series of mammal-bearing beds of this basin. The name was originally used by Hayden for a group of formations in the vicinity of Evanston in southwestern Wyoming, the uppermost of which, and the only one containing mammals, has been designated by Veatch the Knight formation. The known fauna of the typical Knight beds is a very small one and the material is very fragmentary. The types of Cope have been either too fragmentary or too uncharacteristic to be of much value for accurate correlation. A small collection obtained by the writer from the type locality in 1906 does, however, contain some characteristic forms and a recent examination of this material shows that the fauna is more nearly that of the Lysite than of any other Bighorn horizon. The genus *Heptodon* is present and the species of *Hyopsodus* and *Cynodontomys* are Lysite species. The beds lying below the Lysite in the Bighorn basin were referred by Sinclair and Granger to the Knight but it now seems that a new name is needed to distinguish this most important Lower Eocene faunal horizon and the name **Gray Bull** beds is proposed.

Besides the exposures along the Gray Bull River these beds are found to the southward on all but the upper parts of Elk, 5 Mile, and 10 Mile Creeks, and east of the Bighorn River near Worland. To the north of the Gray Bull they outcrop along Dry and Coon Creeks and are exposed extensively about the eastern and northern base of McCulloch Peak. In the Clark Fork basin they are exposed in the southwestern part along the heads of Big and Little Sand Coulees, where they are of a uniform gray color instead of the usual gray, red and yellowish banding.

The party of 1911 obtained from low-lying gray shales at the southwestern base of McCulloch Peak and also from the vicinity of the low divide between the Clark Fork and Bighorn basins north of Ralston a small collection of mammals which appeared to represent a fauna distinctly different from that of the *Systemodon* beds, and in the McCulloch Peak locality there appeared to be an angular unconformity between this horizon and the beds with *Systemodon*. It was suggested by Sinclair and Granger that if, when the fauna became better known, it were deemed advisable to give these lower beds a distinct name they might be called the Ralston

beds or Ralston formation.[1] In 1912 the writer with the assistance of Mr. Wm. Stein made a careful search of these beds in the Clark Fork basin and in the Bighorn basin along the bluff which lies a few miles north of Ralston and Powell, and still further collecting was done in this region last season by Messrs. Stein and P. L. Turner. The fossils obtained, representing nearly 200 individuals, demonstrated clearly that this horizon is a very distinct one, older than the Gray Bull and perhaps representing the top of the Paleocene Series. Unfortunately the name "Ralston" is preoccupied [2] and the name **Clark Fork** beds is substituted. The Clark Fork beds are exposed principally in the Clark Fork basin and in the adjoining part of the Bighorn basin along the bluff lying north of Ralston and Powell, also at the southwestern base of McCulloch Peak. The maximum thickness of the beds is at least 500 feet and they rest upon beds whose age is not positively determined, perhaps Cretaceous, perhaps Fort Union. Whether or not there is an unconformity at this point the writer is unable to say. The beds are sparingly fossiliferous throughout the area examined. In the bluff in the northern part of the Bighorn basin characteristic fossils were found as far east as a point north of Powell. In the Clark Fork basin the fossils were obtained from both sides of the wagon road where it drops down to Big Sand Coulee from the Bighorn basin divide, also from the extensive area between Big and Little Sand Coulees and from the opposite side of Clark Fork River between the mouths of Line and Little Rocky Creeks.

The Clark Fork fauna is characterized by the absence of Perissodactyls, Artiodactyls, Rodents, and Primates, and by the predominance of Phenacodonts of the genera *Phenacodus* and *Ectocion,* specimens of these two genera constituting three-fourths of the collection obtained. The Amblypoda are represented by *Coryphodon* and a primitive form of *Bathyopsis.* Creodonts of several Lower Eocene genera are present and the species in most cases are more primitive than the Gray Bull species. The genus *Esthonyx* is fairly common but the two species are distinct from Gray Bull species. So far as known the mammalian fauna does not include any Torrejon or Fort Union [3] genera not found in the overlying Gray Bull beds but it does include many Gray Bull genera which do not extend down to the Torrejon or Fort Union. However, the reptilian genus *Champsosaurus* is not uncommon and this is distinctly a Cretaceous and Paleocene form. This with the absence of the four orders of mammals mentioned above,

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[1] *Loc.cit.,* 1912, p. 60.

[2] *Ralston Group,* a division of the Pennsylvania Series, Gould, Ohern and Hutchison. State Univ. of Oklahoma, Research Bulletin, No. 3, 1910, p. 13.

[3] By Fort Union is meant the fauna from Sweetgrass County, Montana, as described by Douglass and Gidley.

which is the most important feature of the fauna, favor the placing of these beds as Paleocene rather than Lower Eocene.

Near the head of Big Sand Coulee in the Clark Fork basin there is a series of about 200 feet of red-banded shales lying between the gray shales of the Clark Fork and the *Systemodon*-bearing gray shales above which are referred to the Gray Bull beds. The outcrop of these red-banded beds extended, from the high bluff on the south side of the Coulee, in a northwesterly direction across the basin for several miles. The dip is to the southwest and the beds appear to be comformable with the overlying strata. There may be an angular unconformity between this series and the underlying Clark Fork beds, but it is not evident without the aid of instruments. This horizon does not contain *Systemodon* but it does contain the Perissodactyl genus *Eohippus* in abundance as well as Artiodactyls, Rodents and Primates, and marks the first appearance of these four orders. It also marks the last appearance of the primitive order Multituberculata which is represented in this horizon by a genus of Plagiaulacids. The fauna is radically different from the Clark Fork. From the Gray Bull it differs in the absence of *Systemodon,* in the presence of the Plagiaulacid, and in the generally more primitive character of such genera as are common to both horizons. Altogether the fauna is sufficiently distinct to be separately designated and the name **Sand Coulee** beds is proposed for the horizon. Besides the outcrop mentioned above this horizon is exposed for a small area on the point of the bluff, about four miles northeast of Ralston, and again on the south bank of Clark Fork River, just above the mouth of Pat O'Hara Creek. It is possible that it occurs further to the south, also, along the Shoshone River, but its presence there has not been noted.

New Mexico.

The thickness of the Wasatch beds of northwestern New Mexico has been estimated at about 1000 feet and mammalian fossils occur throughout the greater part of the vertical range. The beds have much the same general appearance of those of the Wasatch group in the Bighorn basin, red, gray, and ochraceous bands of shales and sandstones, and there is no evident unconformity throughout the series. Cope who first explored the region for fossils obtained a collection comprising some twenty genera of mammals but the levels of these specimens, many of which are generic types, has not been known, although an examination of Cope's field notebook in which the specimens collected each day were rather carefully recorded affords a clue to the level of some of them. In 1912 the writer and Mr.

Stein covered pretty thoroughly nearly all of the fossil-bearing portions of those beds, which lie in the neighborhood of Gallina, Ojo San José, and La Hara, and a fairly good representative collection was secured. The fauna as a whole presents a rather different facies from that of the Bighorn Wasatch. Particularly to be noted in this connection is the absence in New Mexico beds of all Perissodactyls, with the exception of *Eohippus*, which is very abundant. This difference in fauna, which is probably to be accounted for by the wide geographical separation of the locality, makes it advisable, it seems, to use distinct horizon names for the New Mexico beds. The fauna falls into two divisions, the upper one, characterized by the Condylarth genus *Meniscotherium*, resembling the Lost Cabin fauna in general,[1] and the lower one with characters of both the Lysite and Gray Bull. The lower horizon, comprising roughly the lower two-thirds of the New Mexico Wasatch, may be referred to as the **Almagre** beds and the upper horizon, comprising the remaining third, the **Largo** beds. The division between the two horizons as indicated by the first appearance of *Meniscotherium* is found about fifty feet above the low divide which separates the headwaters of Largo Cañon and the southwest branch of Almagre Arroyo, about five miles northwest of Ojo San José. The Almagre beds are exposed over the greater part of the Almagre watershed and also at the head of the Arroyo Blanco, this latter locality being the first of the great "horseshoes" mentioned by Cope in his description of the country. The Largo beds are exposed principally in the area drained by the head of Largo Arroyo, in the high bluff just west of Ojo San José, and in all except the base of the second great "horseshoe" of Cope which is southwest of Ojo San José and which is drained by a tributary of the Puerco River. The upper beds are similar in appearance to the lower except that the red strata are more dominant, a condition which is noted in the Bighorn basin also.

In the correlation table given below only the Perissodactyla and two or three genera of other groups have been entered. This correlation, however, is based upon a study of the entire fauna. The tables of occurrence of the genera and species of the Lower Eocene mammals will be given in the articles on the various groups.

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[1] The only recorded occurrence of *Meniscotherium* outside of the New Mexico Wasatch is that of a single specimen of *M. terrærubræ*, the common species, from the Lost Cabin beds of the Wind River basin.

Correlation of Lower Eocene, Wyoming and New Mexico.

	New Mexico "Wasatch"	Evanston (typical Wasatch)	Wind R. Basin (typical Wind River)	Bighorn Basin 'Wasatch"	Clark Fork Basin "Wasatch"
LOWER EOCENE	LARGO (typical) *Eohippus*, *Meniscotherium* *Ambloctonus*		LOST CABIN (typical) *Hyrachyus* *Eotitanops* *Lambdotherium* *Heptodon* *Eohippus* *Meniscotherium*	LOST CABIN *Lambdotherium* *Heptodon* *Eohippus* *Ambloctonus*	
LOWER EOCENE	ALMAGRE (typical) *Eohippus* *Anacodon*	KNIGHT (typical) *Heptodon* *Eohippus*	LYSITE (typical) *Heptodon* *Eohippus*	LYSITE *Heptodon* *Eohippus* *Anacodon*	
LOWER EOCENE	[Unconformity between Wasatch (Almagre beds) and Torrejon]			GRAY BULL (typical) *Systemodon* *Eohippus*	GRAY BULL *Systemodon* *Eohippus*
LOWER EOCENE			?	SAND COULEE *Eohippus* etc.	SAND COULEE (typical) *Eohippus* (abundant) First Artiodactyls, Rodents & Primates ?
PALEOCENE	TORREJON No Perissodactyls etc. Fauna more primitive than in Clark Fork			CLARK FORK No Perissodactyls etc. Fauna more advanced etc.	CLARK FORK (typical) No Perissodactyls, Artiodactyls, Rodents or Primates Fauna more advanced than in Torrejon

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Article XVI.— PETROGRAPHIC ANALYSIS OF THE BRIDGER, WASHAKIE, AND OTHER EOCENE FORMATIONS OF THE ROCKY MOUNTAINS.

By Albert Johannsen.

With Introductory Note by W. D. Matthew.

Introductory Note.

During the last few years we have come to a much better appreciation of the source and method of deposition of the Tertiary formations of the western interior region.

A clear and correct understanding of the nature of these strata is of fundamental importance in paleontology, because the physical and geographic conditions under which they were formed constituted the environment of the mammalian life of the western Tertiary as we know it. So far as the environment conditioned the evolution of our tertiary mammals, a correct interpretation of the stratigraphic record is a necessary prerequisite to understanding the causes of their evolution.

Two general conclusions have resulted from the physiographic, stratigraphic, and paleontologic re-study of these beds in recent years.

1. They are in the main of fluviatile and loess origin. True lacustrine strata are of subordinate importance.

2. Volcanic ash and tuffs, either of primary deposition, or worked over to a varying extent by water, form a surprisingly large percentage of their material.

In order to determine the proportion of volcanic material in these rocks, petrographic examination is indispensable. Preliminary examinations, especially in the Bridger and Washakie beds, by W. J. Sinclair, had shown that these formations were chiefly composed of volcanic material more or less reärranged by stream action, and that volcanic dust, altered to a varying degree and mixed with normal sedimentary materials, constituted at least a large part of other Tertiary formations of the Mountain and Plains regions. Realizing the important bearing of this determination upon several problems of correlation and evolution upon which he was engaged, Professor Osborn, as Vertebrate Paleontologist to the United States Geological Survey, submitted to the Survey for examination a fairly complete and typical series of rock specimens from the formations of the Western States

from which Eocene mammals have been chiefly obtained. This more thorough and exact examination was intrusted by the Director of the Survey to Dr. Albert Johannsen, Acting Chief of the Section of Petrology, whose report is published herewith, through the courtesy of the United States Geological Survey.

The examination confirms in the main the preliminary results obtained by Dr. Sinclair. The specimens examined from the Middle and Upper Eocene formations are chiefly tuffs of volcanic origin; in the Lower and Basal Eocene the sediments are of more normal type, and volcanic material, if present, so much altered by resorting and mixing with normal sediment as not to be clearly recognizable.

It should be observed, however, that the specimens from the Lower and Basal Eocene were few in number and so much altered by weathering that Dr. Johannsen does not pronounce positively as to their nature.

In Dr. Johannsen's paper, for purposes of comparison, the series of specimens has been arranged in order of their geologic sequence in the various formations, from above downward.

The successive horizons are shown in the accompanying diagram (Fig. 1).

The more exact sequence in the Washakie formation is shown in Fig. 2.

Dr. Johannsen observes that although the minerals of the tuffs are those of a dacite (quartz-andesite), the quartz grains may be of sedimentary origin, and the volcanic rock may be an andesite.

He does not confirm Sinclair's identification of the Bridger tuffs as rhyolitic; this removes a serious difficulty in the correlation of the Upper Bridger with the Lower Washakie, which was based by Osborn on faunal evidence, and is now in conformity with the petrographic evidence.

Dr. Johannsen's report and accompanying letter follow.

W. D. Matthew.

American Museum of Natural History.

Letter of Transmittal.

Prof. H. F. Osborn,
American Museum of Natural History.

Dear Sir:

To answer the question as to the origin of rocks altered as much as the specimens sent by you, and the Bridger rocks I received from the National Museum, is very difficult. From the hand specimens and the thin sections

it is generally impossible to determine whether the material was transported by water, or whether the rock is almost a direct sediment from a volcanic eruption. That the fragments of minerals in the rocks have been derived from volcanic rocks is plain, but nothing, unless it is sometimes a slight rounding of the grains, indicates whether or no they have been transported. The separation line between a sediment from eruptive material and a tuff seems to me a very uncertain one and based on the distance of transportation. In the specimens determined for you, the appearance of the minerals in most of the slides is that of broken fragments from igneous rocks. In many of the slides they appear like the fragments of minerals from a rather coarsely crystalline quartz diorite rather than from a dacite. The large amount of apparently primary quartz would indicate a quartz monzonite or some similar rock as having been the source. It is possible, however, that these are fragments of the minerals of the rock through which the eruption took place, and that the groundmass represents glassy material of the new lava. Many of the slides do undoubtedly contain particles of glass dust. The groundmass in almost all of the sections is so largely altered to secondary minerals that it is impossible to say whether it was originally the dust of a volcano or whether this glassy material might not have been washed down later with fragments of the granular rock. In many of the slides the character of the cement is also modified by the infiltration of calcite.

Personally, I am inclined to believe that the rocks are largely tuffs, perhaps modified in part by slight transportation, enough to add the many quartz grains found. The rocks in many cases contain fragments of other eruptive rocks which have probably been brought up from the strata broken through by the rising lava. Some of the rocks in which the material is that of an eruptive rock may actually be sedimentary. This may also account for the presence of such a large amount of quartz in the sections, that is, *instead of being eruptive dacite tuffs they may be formed of the materials of an andesite, with sedimentary quartz grains.*

Yours truly,

Albert Johannsen,
Acting Chief,
Section of Petrology.

United States Geological Survey,
Washington, February 4th, 1909.

Petrographic Report on Rocks.

UINTA.[1]

No. 4.— Altered Eruptive; probably Dacite Tuff.

Locality: Uinta. Hor. C.

Megascopic: A grayish green fine-grained rock with a rough feel, containing many small black spots of biotite.

Microscopic: Irregular broken fragments of CaNa plagioclase, biotite, hornblende, muscovite, quartz?, and some secondary zeolite, in a yellowish green partially devitrified groundmass. There is considerable glass.

No. 3.— Altered Eruptive; probably Dacite Tuff.

Locality: Uinta. Top of Hor. B or base of Hor. C.

Megascopic: A greenish gray fine-grained rock, with a rough feel.

Microscopic: Irregular broken fragments of quartz, CaNa plagioclase, and a dark altered indeterminable ferromagnesian mineral in a dirty dark brown groundmass similar in appearance to No. 2. There are traces of what appears to be glass.

No. 1.— Altered Eruptive; probably Dacite Tuff.

Locality: Uinta. Top of Hor. B.

Megascopic: A pale green, fine-grained rock containing large dark brown inclusions.

Microscopic: Irregular broken fragments of CaNa plagioclase, biotite, and some quartz and apatite in a greenish brown anisotropic groundmass. This groundmass is full of secondary sericite, and is probably a devitrified glass although no remnants of glass remain. The rock has much the appearance of a dacite tuff. No fragments of the dark inclusions appear in the thin section.

No. 2.— Altered Eruptive; probably Dacite Tuff.

Locality: Uinta. Hor. B.

Megascopic: A red-brown, fine granular rock.

Microscopic: Irregular broken fragments of CaNa plagioclase, quartz, apatite, and a dark altered indeterminable mineral in a dark brown altered groundmass containing much calcite, sericite and iron oxide. No fresh glass seen.

No. 6.— Probably a Sediment.

Locality: Uinta. Hor. B.

Megascopic: A pinkish rock containing many small rounded pebbles.

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[1] All from Uinta basin, northeastern Utah.

Microscopic: Rounded and irregular fragments of CaNa plagioclase, quartz, garnet, augite, and fragments of other rock in a dirty yellowish brown groundmass, which consists of calcite, probably some zeolites and

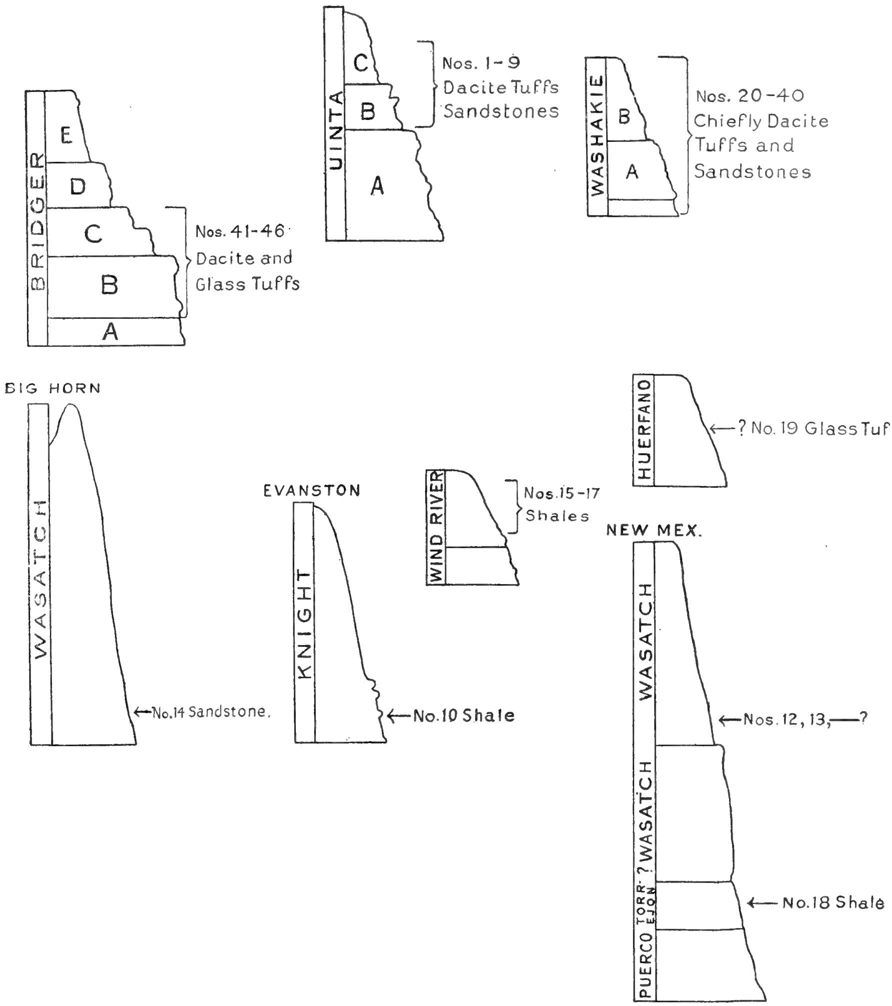

Fig. 1. Key to the chronologically successive and overlapping formations from which specimens Nos. 1 to 46 were obtained.

glass. In the hand specimen the rock looks like a sandstone. Under the microscope it closely resembles many flow breccias.

No. 8.— Possibly SEDIMENTARY.

Locality: Uinta. Hor. B.

Megascopic: Similar in appearance to 5 and 6. It is coarser than 5 and finer and more compact than 6. In color pinkish brown. It shows rounded as well as broken grains in a granular groundmass. Microscopically it has much the appearance of a sandstone.

Microscopic: Irregular fragments of CaNa feldspar, quartz and a rock with microlitic texture, either andesite or basalt, in a groundmass which is largely calcite, some zeolites.

No. 7.— Altered Eruptive; probably Dacite Tuff.

Locality: Uinta. Hor. B.

Megascopic: A pinkish brown, rough, fine granular rock containing included fossils.

Microscopic: Very small fragments of CaNa feldspar, quartz? and altered ferromagnesian mineral in a very dark brown groundmass almost opaque, consisting in part at least of calcite. The rock may be a tuff or a sediment.

No. 5.— Minerals of a Dacite or Diorite; possibly a Sedimentary Rock.

Locality: Uinta. "Base of Hor. B."

Megascopic: A brownish, fine granular, rough rock.

Microscopic: Broken and rounded fragments of quartz, CaNa plagioclase, hornblende, a dark altered indeterminable mineral, fragments of andesite or basalt. These minerals are in comparatively large grains nearly touching each other, and united by a small amount of cement which is largely calcite. The rock may be a sediment with the materials derived chiefly from a diorite.

No. 9.— Altered Eruptive; probably Dacite Tuff.

Locality: Uinta. Hor. A.

Megascopic: Yellowish, medium-grained, rough rock containing a few rounded pebbles.

Microscopic: Irregular broken and rounded fragments of quartz, CaNa feldspar, hornblende, biotite and fragments of an andesite or basalt in a dirty brown groundmass, which is chiefly chlorite with some calcite. The grains are rather large and are partly rounded. They form most of the rock with the exception of a rim of chlorite, etc., around each.

WASHAKIE.[1]

No. 39.— Grit. Minerals derived from granite.

Locality: Washakie. Hor. B. Summit of formation.

Megascopic: Coarse rounded quartz grains, stained a light green, in a small amount of calcareous cement.

[1] All from Washakie basin, southern Wyoming.

Microscopic: Similar in appearance to No. 38. Each grain is surrounded by a yellowish green rim of chlorite and iron oxide.

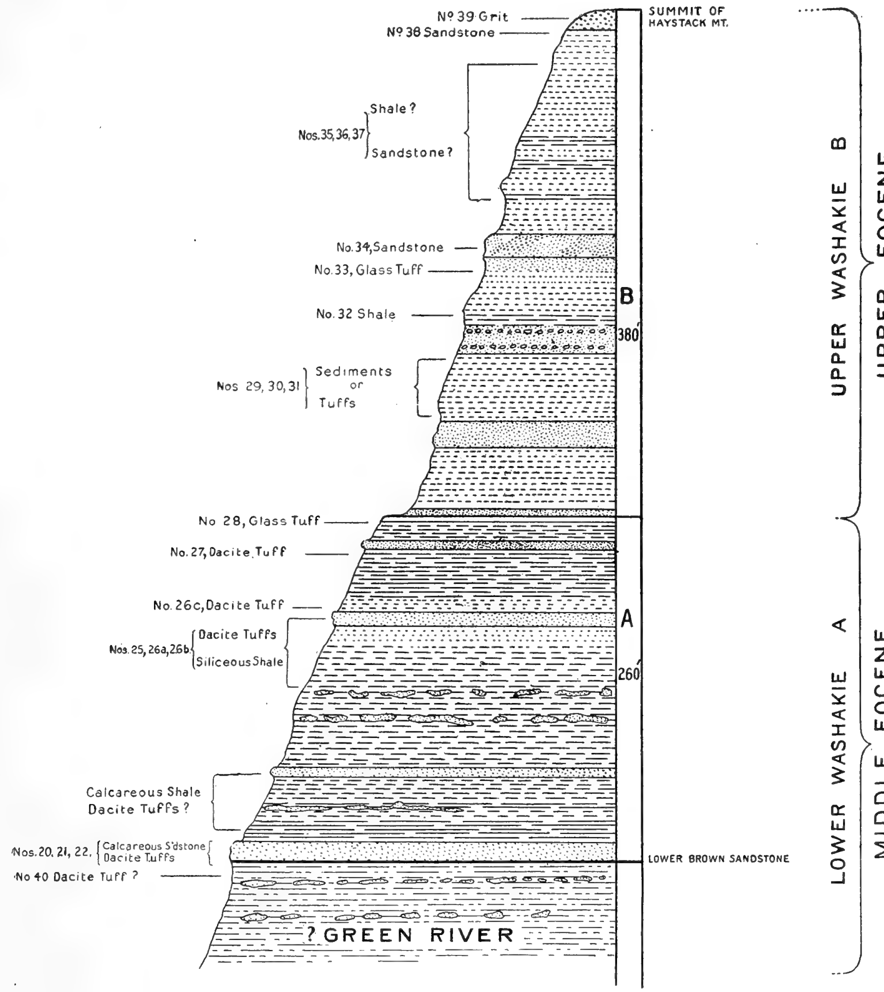

Fig. 2. Section through the Washakie beds near Barrel Springs, Southern Wyoming, showing the approximate levels of specimens Nos. 20 to40. After Granger, with modifications.

No. 38.— Sandstone. Minerals derived from a granite.

Locality: Washakie. Hor. B (Barrel Springs Section 22) [1].

Megascopic: A coarse granular light brown rock.

[1] The numbers in parentheses refer to the section, by Walter Granger, of the Washakie beds near Barrel Springs. See Bull. Amer. Mus. Nat. Hist., Vol. XXVI, 1909, p. 19.

Microscopic: Rather rounded grains of quartz and microline in a cement of secondary crystals. Similar in appearance to No. 34.

No. 37.—

Locality: Washakie. Hor. B (Barrel Springs Section 21).

Megascopic: A light green, slightly sandy rock.

Microscopic: The section was almost destroyed in grinding. All that remains are a few very small broken mineral grains. The rock was possibly an altered eruptive.

No. 36.— SHALE?

Locality: Washakie. Hor. B (Barrel Springs Section 21).

Megascopic: A compact shale-like rock, light green in one part and light brown in another.

Microscopic: Anisotropic, consisting largely of minute grains of iron oxide and sericite?

No. 35.— SANDSTONE? TUFF?

Locality: Washakie. Hor. B (Barrel Springs Section 21).

Megascopic: A fine-grained, light red, sandy rock. Looks like a sandstone.

Microscopic: Chiefly broken quartz grains, with some plagioclase in a greater amount of a yellow groundmass.

No. 34.— Coarse SANDSTONE derived from a granite.

Locality: Washakie. Hor. B (Barrel Springs Section 20).

Megascopic: A rather coarse rock consisting of rounded grains of quartz and feldspar, with almost no cement.

Microscopic: Quartz and microcline and a very few hornblende fragments, generally rounded, with a very small amount of yellowish green cement which is largely calcite.

No. 33.— GLASS TUFF.

Locality: Washakie. Hor. B (Barrel Springs Section 19).

Megascopic: A compact white rock similar in appearance to No. 28.

Microscopic: A very few exceedingly small fragments of hornblende?, quartz ?, and feldspar in a slightly devitrified groundmass of angular glass particles.

No. 32.— SHALE? TUFF?

Locality: Washakie. Hor. B (Barrel Springs Section 18).

Megascopic: A compact, pale yellow, fine-grained rock.

Microscopic: Few and small fragments of quartz and plagioclase? in a dirty brown indeterminable groundmass, which is partly calcite and sericite.

No. 31.— Minerals of a DACITE or QUARTZ DIORITE. The rock may be a sediment.

Locality: Washakie. Hor. B (Barrel Springs Section 15).

Megascopic: A light green, friable, sandy rock similar in appearance to No. 27.

Microscopic: Fragments of quartz, NaCa feldspar, augite, hornblende and an opaque alteration product in a groundmass of a greenish color, consisting largely of chlorite and calcite. The mineral fragments are very much altered.

No. 30.—

Locality: Washakie. Hor. B (Barrel Springs Section 15).

Megascopic: A pale pink, rather friable, sandy rock showing rounded quartz and augite? grains in a light-colored opaque groundmass.

Microscopic: A very few grains of quartz, hornblende, NaCa feldspar and a microlitic rock in a groundmass which consists chiefly of calcite, with some zeolite? patches.

No. 29.— Minerals of the DACITE. The rock may be a SEDIMENT or a TUFF.

Locality: Washakie. Hor. B (Barrel Springs Section 15).

Megascopic: A yellowish green, friable, sandy rock similar in appearance to No. 27.

Microscopic: Rather rounded irregular grains of quartz, NaCa plagioclase and other rock fragments in a deep brown groundmass.

No. 28.— GLASS TUFF.

Locality: Washakie. Hor. A (Barrel Springs Section 10).

Megascopic: A white compact rock showing deposition lines and inclusions.

Microscopic: A very few small broken fragments of hornblende and quartz? in a partially devitrified glass. Some of the glass is rather fresh. This rock is a transition stage between a fresh glass tuff and the tuff showing but little fresh glass in the groundmass. The outlines of the original angular glass particles are perfectly preserved.

No. 27.— ALTERED ERUPTIVE, DACITE TUFF?

Locality: Washakie. Hor. A (Barrel Springs Section 9).

Megascopic: A pale green, rather coarse granular rock, rough to the touch. It is coarser than 26c.

Microscopic: Rather coarse broken fragments of quartz, CaNa plagioclase, augite, hornblende, other rock fragments and iron oxide in a yellowish groundmass which appears to be partly devitrified glass. Remnants of glass remain. There are some zeolites. The broken crystal fragments are about equal in amount to the groundmass.

No. 26c.— ALTERED ERUPTIVE; probably DACITE TUFF.

Locality: Washakie. Hor. A (Barrel Springs Section 7).

Megascopic: A fine-grained pale greenish rock, rather rough to the touch. Slightly banded. Similar in appearance to 26b.

Microscopic: Quartz, CaNa plagioclase, microcline, hornblende and an opaque, black, altered ferromagnesian mineral in rather coarse, irregular,

broken fragments in a brown groundmass which consists largely of calcite and partially devitrified glass. A chemical test on the pulverized material to determine whether a glass or a zeolite is present in the groundmass shows no gelatinization. Consequently the isotropic material in the groundmass, which has an index lower than Canada balsam, is glass.

No. 26*b*. The minerals are of an Eruptive Rock. May be Dacite Tuff, or a sediment derived from a dacite tuff.

Locality: Washakie. Hor. A (Barrel Springs Section 6 and 8).

Megascopic: A greenish yellow, slightly rough, fine-grained rock.

Microscopic: Small irregular broken fragments of quartz, CaNa feldspar and an altered ferromagnesian mineral in a dirty brown groundmass, which contains zeolites, sericite, iron oxide, and possibly glass?.

No. 26*a*. Siliceous Shale?

Locality: Washakie. Hor. A (Barrel Springs Section 6).

Megascopic: A mottled green to brown siliceous rock.

Microscopic: Extremely fine-grained slightly anisotropic material, consisting of an indeterminable anisotropic mineral, sericite, and small grains of red iron oxide. It appears to be a siliceous shale.

No. 26.— Dacite Tuff, or a sediment formed from the minerals of a dacite.

Locality: Washakie. Hor. A (Barrel Springs Section 6).

Megascopic: A grayish rock, rough granular, and coarser than No. 25. Similar in texture to No. 22 though lighter in color.

Microscopic: Quartz, NaCa feldspar, augite, an opaque altered ferromagnesian mineral, garnet and a microlitic rock. All in irregular broken fragments in a cement which may be devitrified glass. It has more the appearance of a sediment than No. 22.

No. 25.— Altered Eruptive; probably Dacite Tuff.

Locality: Washakie. Hor. A (Barrel Springs Section 2).

Megascopic: A pale green rock, very similar to No. 24.

Microscopic: Broken fragments of quartz, NaCa feldspar, augite, some freshly altered ferromagnesian mineral in a pale yellowish devitrified groundmass. Zeolites or remnants of glass in the groundmass.

No. 24.— Altered Eruptive; probably Dacite Tuff.

Locality: Washakie. Hor. A (Barrel Springs Section 2).

Megascopic: A light gray, very fine-grained, slightly rough rock.

Microscopic: Few and small fragments of quartz, NaCa feldspar and an altered ferromagnesian mineral in a pale yellow groundmass, which is anisotropic in spots but shows the glassy texture, and remnants of an unaltered glass. This is a transition stage between the totally devitrified groundmass and the fresh glass. There is considerable chlorite and sericite in the groundmass, possibly some zeolites.

No. 23.— Impure Limestone or Calcareous Shale.

Locality: Washakie. Hor. A (Barrel Springs Section 2).

Megascopic: A yellowish gray fine-grained rock.

Microscopic: Very fine granular. It consists almost entirely of calcite grains, with a few fragments of augite, quartz, iron oxide and a few other altered minerals.

No. 22.— Altered Eruptive; probably Dacite Tuff.

Locality: Washakie. Hor. A. (Barrel Springs Section 1).

Megascopic: A yellowish rock, rough to the touch, showing fine quartz and mica grains in an altered yellowish groundmass.

Microscopic: Irregular broken fragments of quartz, NaCa feldspar, hornblende, biotite (considerably altered), an opaque black ferromagnesian mineral, garnets, and an altered microlitic rock, all broken and irregular in a yellow anisotropic, speckled groundmass, probably devitrified glass. Secondary zeolites and possibly some unaltered glass? occur. It has the appearance under the microscope of an altered tuff, although the hand specimen shows some rounded quartz grains which suggest that the minerals were deposited by water.

No. 21.— Altered Calcareous Sandstone, the minerals derived from an igneous rock.

Locality: Washakie. Hor. A (Barrel Springs Section 1).

Megascopic: Rather coarse greenish yellow rock showing rounded quartz and other mineral grains in a small amount of yellowish calcareous cement.

Microscopic: Irregular broken fragments of quartz, NaCa feldspar, augite and a microlitic rock (probably andesite) in a groundmass of perfectly crystalline calcite. The minerals are entirely fresh and were derived from an igneous rock. The appearance of the mineral suggests a diorite, although the rock is probably a sediment.

No. 20.— Altered Eruptive; probably Dacite Tuff.

Locality: Washakie. Hor. A (Barrel Springs Section 1).

Megascopic: A rough, yellowish, fine-grained rock showing a number of dark flakes, apparently biotite.

Microscopic: Broken irregular fragments of quartz, NaCa feldspar, hornblende and another altered ferromagnesian mineral, probably biotite, in a brown, slightly anisotropic altered groundmass which shows zeolites and possibly some unaltered glass.

No. 40.— Altered Eruptive; probably Dacite Tuff.

Locality: ? Washakie. (Below lower brown sandstone 1).

Megascopic: A light gray fine grained rock, slightly rough to the touch.

Microscopic: A few very small grains of quartz, NaCa feldspar and altered biotite? in a groundmass which is partly calcite and partly glass. The calcite appears to be entirely secondary. Secondary zeolites.

BRIDGER.[1]

No. 46.— Dacite Tuff?

Locality: Burnt Fork. Hor.? D.

Megascopic: Similar in appearance to No. 45 though a little greener in color.

Microscopic: Somewhat coarser than No. 45. Irregular grains of quartz, CaNa feldspar, hornblende, black iron oxide, biotite? and fragments of a microlitic rock in a yellowish chloritic groundmass.

No. 45.— Glass Tuff.

Locality: Sage Creek. Hor. C.

Megascopic: Soft, friable, white rock, rough to the touch, and containing numerous very fine black particles.

Microscopic: A few quartz and hornblende? fragments in a groundmass made up entirely of coarse angular particles of stringy glass full of bubbles. There is a little secondary calcite.

No. 44.— Dacite Tuff?

Locality: Smith's Fork. Hor. B.

Megascopic: A greenish gray fine-grained rock.

Microscopic: Fragments of quartz, NaCa feldspar, hornblende and black iron oxide in a dirty brown groundmass consisting of sericite, chlorite and calcite. No glass seen.

No. 43.— Green Altered Tuff; probably Dacite Tuff.

Locality: Church Buttes. Hor. B.

Megascopic: A rather dark green sandy rock, showing some flakes of a dark mineral. The rock breaks in flat sheets showing bedding.

Microscopic: Fragments of quartz, NaCa plagioclase, a little alkali feldspar, red and black iron oxide, an altered ferromagnesian mineral and fragments of another rock in a groundmass consisting of calcite and chlorite. The material may have been deposited in water.

No. 42.— Dacite Tuff?

Locality: Church Buttes. Hor. B.

Megascopic: A fine-grained grayish rock containing a few fossils and numerous black specks of hornblende and possibly mica.

Microscopic: Irregular broken fragments of quartz, NaCa feldspar, hornblende, fragments of other rocks and black iron oxide in a groundmass which contains considerable calcite, sericite and other secondary products. It may be a devitrified glass but no remnants remain.

No. 41.— Dacite Tuff?

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[1] All from Bridger basin, southern Wyoming.

Locality: North of Church Buttes. Hor. A.

Megascopic: Rather coarse, rough, granular rock of a dirty green color.

Microscopic: Fragments of quartz, NaCa feldspar, hornblende and a microlitic rock in a groundmass consisting of calcite, chlorite and sericite. No glass seen.

HUERFANO.

No. 19.— Glass Tuff.

Locality: Huerfano basin, Colorado.

Megascopic: White volcanic dust.

Microscopic: Irregular angular fragments of clear, fresh and unaltered glass. There are a very few small indeterminable fragments, perhaps quartz.

WIND RIVER.

No. 17.— Sandy Shale?

Locality: Wind River basin, Wyo.

Megascopic: A pale green, rough, very fine, friable, granular rock.

Microscopic: Irregular fragments of quartz, altered biotite and feldspar? in a greenish, much altered groundmass consisting partly of sericite and chlorite. The rock may be a sediment or an altered eruptive. Indeterminable.

No. 16.— Probably Shale.

Locality: Wind River basin, Wyo.

Megascopic: A pale green aphanitic rock containing a few reddish fragments.

Microscopic: Very small indeterminable mineral fragments, probably quartz, in a yellowish groundmass which is largely sericite, and a mineral with low birefringence, either feldspar or quartz.

No. 15.—

Locality: Wind River basin, Wyo.

Megascopic: Mottled green and reddish brown. The green patches appear to be fragments of shale.

Microscopic: The thin section shows chiefly the dark red rock. It consists of fragments of quartz and CaNa feldspar in an opaque groundmass, which in places where ground very thin shows a red rim. It is probably hematite. There is only one small fragment of what appears to be the green part of the rock. This is much more transparent than the remainder of the slide, and consists of many grains of red iron oxide in a pale greenish anisotropic groundmass of sericite and an indeterminable mineral, probably partly chlorite. It has the appearance of a shale.

WASATCH.

No. 10.— Calcareous Shale.

Locality: Evanston, Wyo.

Megascopic: A yellowish white fine-grained rock.

Microscopic: Extremely fine-grained. It consists chiefly of calcite, with considerable iron oxide and quartz.

No. 14.— Sedimentary Rock.

Locality: Bighorn basin, Wyo.

Megascopic: A reddish brown, friable, sandy rock.

Microscopic: Irregular and rounded grains of quartz and feldspar ?, a little biotite, and some dark altered ferromagnesian mineral in a groundmass of calcite.

No. 12.— A pink and yellow, very much Decomposed Rock.

Locality: San Juan basin, New Mexico.

Megascopic: Pink to yellow rock; has the appearance of a dried clay.

Microscopic: Small grains of quartz and plagioclase ? in a very much altered groundmass containing considerable calcite. The rock is too much altered to determine.

No. 13.— Probably a Sediment with the minerals of a Rhyolite.

Locality: San Juan basin, New Mexico.

Megascopic: A sandstone-like pale green rock containing rounded quartz grains in a compact groundmass.

Microscopic: Irregular fragments of quartz and an altered alkali feldspar in a yellowish groundmass, very much altered.

TORREJON.

No. 18.— Shale?

Locality: San Juan basin, New Mexico.

Megascopic: A dirty reddish brown fine-grained rock, rather rough to the touch.

Microscopic: Some quartz, plagioclase and altered ferromagnesian mineral in a dominant dark brown groundmass. This groundmass is very much altered and now consists of sericite, chlorite and other secondary products. Its original character is indeterminable.

50.81,9C:14.71,1

Article XVII.— THE DORSAL VERTEBRÆ OF *CAMARASAURUS* COPE.

By Charles C. Mook.

The reëxamination of the type material of the genus *Camarasaurus* Cope in the American Museum of Natural History collection has been entrusted to the writer by Professor Henry Fairfield Osborn in preparation for his monograph on the Sauropoda to be published by the United States Geological Survey. It is many years since the *Camarasaurus* types have been carefully examined and in the meantime our knowledge of the Sauropoda has made great advances through the discovery of several complete skeletons.

From our present knowledge of *Camarasaurus* the vertebral formula is as follows: cervicals 13, dorsals 10, sacrals 5, while the number of caudals is unknown.

The type species of *Camarasaurus* is *C. supremus*, and the type specimen was designated by Cope[1] as a cervical, three dorsal, and four caudal vertebræ. These vertebræ were selected from a large series containing the remains of three or more individuals. These vertebræ are now in the American Museum of Natural History and constitute numbers 5760, 5760[a], 5761, 5761′, 5761″, and 5761[a].

In 1904 and 1905 an attempt was made to form a composite vertebral column by placing the vertebræ in series according to their characters and rejecting the duplicates. It was concluded at that time that the number of dorsals was fourteen, thirteen of these bones being actually represented in the series. Many of the vertebræ are incomplete and others are distorted, so it becomes a difficult matter to ascertain, in many cases, whether two bones are duplicates or not. At present it appears that the number of dorsals has been placed far too high in this composite. Dorsals 10 and 12 of the series are undoubtedly duplicates, 13 and 14, and also 9 and 11, are not more different from each other than is the case with the opposite sides of a single vertebra, and are probably also duplicates; 13 and 14 are both distorted and 14 is very incomplete, and both exhibit different characters on opposite sides. The fourth is very fragmentary and shows no characters intermediate between 3 and 5; 3 and 5, on the other hand, are close enough to be continuous in a series.

The skeleton of *Camarasaurus* as a whole is remarkably similar to that

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[1] Paleontological Bulletin No. 25, published August 23, 1877.

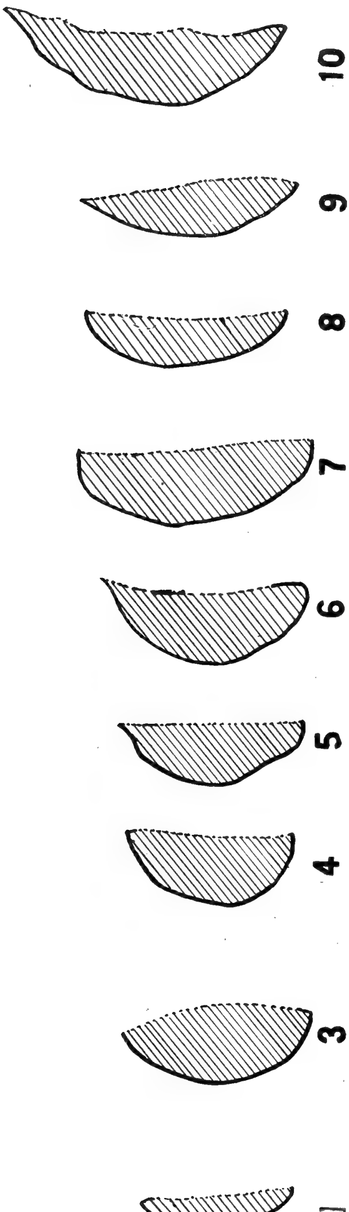


Fig. 1. Diagram showing convexity of anterior ends of centra of dorsal vertebræ of *Camarasaurus* as they would appear in vertical sections. About one-eighth natural size.

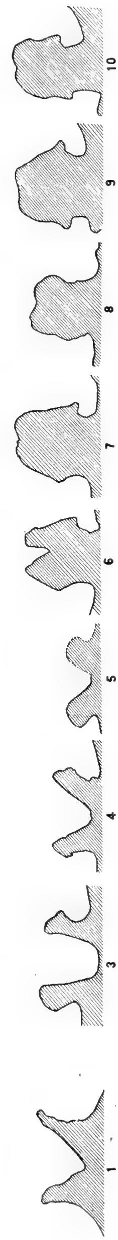


Fig. 2. Diagrams of division of spines of dorsal vertebræ of *Camarasaurus*. About one-thirtieth natural size.

of *Morosaurus,* the only difference being that of size. *Morosaurus* has ten dorsals, shown by a specimen of *Morosaurus* in the Yale Museum, in which the dorsals were found in place. The number of dorsals in *Camarasaurus,* then, is probably ten.

The characters of the dorsals are as follows:

General appearance of dorsals much more massive than in most sauropods. Centra all opisthocœlous, slightly so in the posterior members and increasing gradually anteriorwards, differing in this respect from *Brontosaurus* and *Diplodocus,* in which the posterior dorsals are platycœlian, and the anterior ones strongly opisthocœlian, the latter character beginning abruptly in one of the central dorsals. The pleurocœls are deep, but occupy less of the surface of the centrum than in *Diplodocus.* They are somewhat more rounded than in *Brontosaurus.* The centra are relatively short and broad, the breadth of the posterior ones being twice the length. In the anterior ones the length exceeds the breadth only slightly.

The neural arches are of medium height, and comparatively simple in form. There is a deep infradiapophysial lamina, dividing the infradiapophysial cavity into anterior and posterior halves. The infrapre- and postzygapophysial laminæ are strongly developed. The oblique and intersecting laminæ of *Diplodocus* are absent or feebly developed in the posterior dorsals, though of moderate strength in the anterior ones. Hyposphene-hypantrum articulation strong. Pre- and postzygapophyses very strong and connected by a broad horizontal lamina.

Posterior spines low and broad. Anterior spines low and divided. Transition from single posterior spines to divided anterior spines gradual. Dorsals 10, 9, and 8 have a slight suggestion of a notch at the top, in 7 there is a notch about one inch deep, in 6 a notch about 3 inches deep, in 5 a notch about three and one-half inches deep, and in the anterior four vertebræ the division is complete. The deep supradiapophysial cavity on the side of the spine is divided by the supradiapophysial lamina into a large anterior and a small posterior portion. Pre- and postzygapophysial laminæ strong. On the posterior surface of the spine there is another vertical lamina interior to the postzygapophysial. This may be called the *suprahyposphenal.* Median prespinal lamina very weak, and the median tubercle between the two divisions of the anterior spines of *Diplodocus* is absent. Anterior and posterior surfaces of spines strongly rugose.

Diapophyses very strong, supporting the tubercular processes of the ribs, widest in the anterior vertebræ. Horizontal and infra- and supradiapophysial laminæ form supports for the diapophyses. Tubercular facets for the ribs on ends of the diapophyses, high throughout. Capitular facets high in posterior dorsals, descending gradually anteriorwards until in dorsal 1 it is on the centrum.

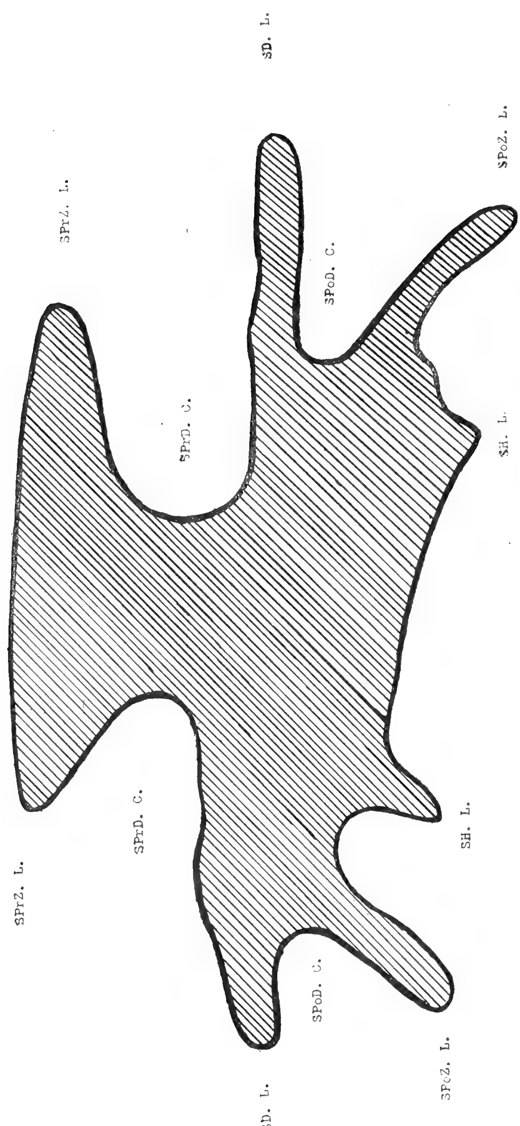


Fig. 3. Transverse section of spine of dorsal 6 showing laminæ and cavities. ½ natural size. SPrZ. L. = Supraprezygapophysial lamina, SPoZ. L. = Suprapostzygapophysial lamina, SD. L. = Supradiapophysial lamina, SH. L. = Suprahyposphenal lamina, SPrD. C. = Suprapradiapophysial cavity, SPoD. C. = Suprapostdiapophysial cavity.

The dorsals of *Camarasaurus* resemble those of *Brontosaurus* in being very robust, those of *Morosaurus* in every important particular except size, those of *Brachiosaurus* in having low broad posterior spines. The resemblance to *Diplodocus* is slight. They differ from those of *Brontosaurus* in having low broad posterior spines, those of *Morosaurus* in being much larger, those of *Brachiosaurus* in being shorter in anterior-posterior direction and in having only three or four spines single, and from those of *Diplodocus* in having low broad spines and more massive simple structure.

56.57,72B

Article XVIII.— THE FOSSIL AND RECENT BOMBYLIIDÆ COMPARED.

By T. D. A. Cockerell.

From the Miocene shales at Florissant, Colorado, we have obtained many fossil Bombyliidæ, all apparently representing extinct genera. The work has now reached a stage which permits a general review, with a discussion of the related living genera. The questions involved are not merely those of the taxonomy of the Bombyliidæ, but include matters of broader scope, concerning the nature of the evolution of new genera among insects. In my former works I was somewhat hindered by the lack of either figures or personal knowledge of several of the most interesting genera of living Bombyliidæ, and while descriptions were sufficient to show that they were not identical with the fossils, more precise information was greatly desired. When recently visiting the U. S. National Museum, I took advantage of the opportunity to examine and sketch parts of the venation of a number of the rarer genera. The diagrammatic sketches I made are published herewith, along with similar sketches of the fossil forms.

At the very outset, it is evident that the relationships between the groups of Bombyliidæ are complex, and no linear arrangement will express them. I will therefore follow, with modifications, the arrangement of Williston's key, which at least has the advantage of giving us a classification which is easy to use. The work is based almost entirely on the venation, as only the wings are adequately preserved in all the fossils. In place of the more usual type of key, I give one in which the contrasted categories bear the same number, with the difference of a letter added, as 1*a*, 1*b*, 1*c*.

1*a*. Præfurca long .... Anthracinæ.

Cyrtosia, which is a Bombyliine, has a remarkably long præfurca, and might be sought here; it is then easily known by the open discal cell.

Mythicomyia, on the character of the præfurca, will be sought here, but it is easily distinguished by the single submarginal cell. It appears to be related to *Glabellula*.

I give a figure of *Aldrichia ehrmanni* Coquillett, taken from the type. Williston's figure seems not quite accurate as to the end of the second vein.

I have never found any trace of an Anthracine in the Florissant shales; it seems probable that the subfamily was absent from Colorado in Miocene times, or at least during the earlier part of that long period. Anthracines have been reported from the Oligocene and Miocene of Europe, but little is known about them. Probably the group originated in the Old World, and on reaching America competed successfully with the endemic groups with

the result that many genera became extinct, and others are represented by rare and isolated species.

1*b*. Præfurca short. All the other groups.

2*a*. Three posterior cells.

3*a*. Discal cell open (confluent with second posterior). *Apolysis* Lw. (Spain, E. Europe, Asiatic Russia.)

3*b*. Discal cell closed.

4*a*. Two submarginal cells.

5*a*. First posterior cell closed; anal closed. *Pachysystropus* Ckll. (Florissant Miocene, two species).

5*b*. First posterior cell open.

6*a*. Anterior cross-vein well before middle of discal cell.

Geronites (n. gen.) **stigmalis** n. sp. (Fig. 9, discal cell.)

Length about 5 mm.; wing 5¼; thorax not hairy; abdomen about as in *Geron*, very thinly hairy; legs with extremely fine short pubescence. As preserved, the insect is ferruginous; it was perhaps yellow or pale reddish in life. There is a stout proboscis, directed forwards, longer than head. Wings clear, with a dark region between the apical parts of the auxiliary and first veins, as in the living *Geron*.

Venation much as in *Geron*, but with the following peculiarities: second submarginal cell long; anterior cross-vein far before middle of discal cell; outer side of discal cell with a strong double curve (this is more or less evident in some species of *Geron*); second basal cell on discal twice as long as on third posterior. The end of the anal cell cannot be seen, but it is so wide in the middle that it is almost certainly open; in *Geron* it is closed.

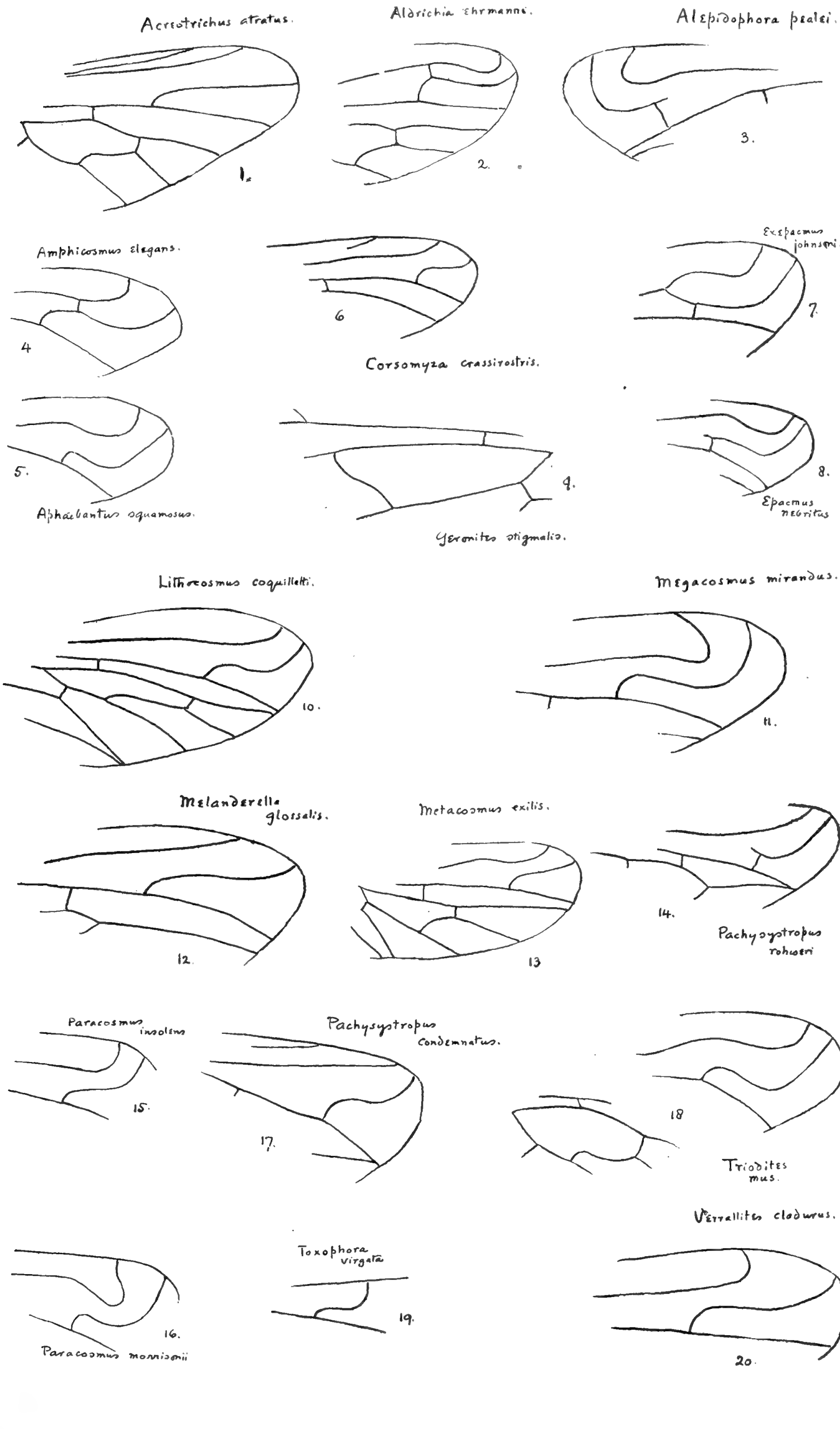
The following measurements are in microns: Second submarginal cell on first posterior 2048; first submarginal on first posterior, 1120; first submarginal on first basal, about 800; origin of præfurca basad of level of base of discal cell, about 560; length of anterior cross-vein, 144; first basal cell on discal, 560; first posterior on discal, 1170; second basal on discal, 320; second basal on third posterior, 160; width of anal at level of end of second basal, 480; end of first vein to end of second, 800.

Miocene shales of Florissant, station 14 (University of Colorado Expedition).

In Williston's table this runs straight to *Geron*, and I believe it is really an ancestral form of that genus, or related thereto.

6*b*. Anterior cross-vein at or a little beyond middle of discal cell; anal closed. *Geron* Meig., a genus which I have taken living at Florissant. It also occurs in the Old World, but there is only one Palæarctic species, whereas the Nearctic ones are numerous. The Nearctic species known to me have a more *Systropus*-like venation than the Old World *G. gibbosus*.

6*c*. Anterior cross-vein considerably beyond the middle of discal cell. Here fall the peculiar living Systropinæ, *Systropus* Wied and *Dolichomyia* Wied. They represent apparently a waning type, which has managed to remain widespread and relatively abundant in the genus *Systropus*, which so closely resembles certain Hymenoptera. The genus *Melanderella* Ckll. (*M. glossalis*


Acreotrichus atratus.
1.
Aldrichia ehrmanni.
2.
Alepidophora pealei.
3.
Amphicosmus elegans.
4
6
Exepacmus johnsoni.
7.
Corsomyza crassirostris.
5.
Aphœbantus squamosus.
9.
Geronites stigmalis.
8.
Epacmus
Lithocosmus coquilletti.
10.
Megacosmus mirandus.
11.
Melanderella glossalis.
12.
Metacosmus exilis.
13
14.
Pachysystropus rohweri
Paracosmus insolens
15.
Pachysystropus condemnatus.
17.
18
Triodites mus.
Verrallites cladurus.
16.
Paracosmus morrisonii
Toxophora virgata
19.
20.

Ckll.), from the Florissant shales, falls here, and is I think a relatively primitive ally of the Systropines, without the exaggerated characters seen in the living genera. It has a complete anal, only just closed on wing-margin. In the wide open first posterior cell, and the second basal much broader on the third posterior than on the discal, it resembles *Dolichomyia* rather than *Systropus;* but the base of the third posterior is straight.

A new specimen of *Melanderella glossalis*, found by Mr. S. A. Rohwer at station 14, Florissant, gives the following measurements in microns: First submarginal cell on first basal, 960; first submarginal on first posterior, 1009; second submarginal on first posterior, 1089; first basal on discal, 816; first posterior on discal, 528; discal on third posterior, 800; second basal on third posterior 224. The anterior cross-vein is a *little* oblique. The strong double curve in the outer side of discal cell is exactly as in *Systropus.*

4*b*. Three submarginal cells. *Toxophora* Meig.; type of subfamily Toxophorinæ. (Europe, Asia, Africa, America.)

2*b*. Four posterior cells.

7*a*. Discal cell confluent with third posterior; only one submarginal.

8*a*. Anterior cross-vein at extreme base of discal cell. *Empidideicus* Beck. (Algeria).

8*b*. Anterior cross-vein far beyond base of discal cell. *Cyrtosia* Perris. (Palæarctic).

Corsomyza Loew, from Baltic Amber, has an open discal cell according to Meunier's figure, kindly copied for me by Mr. S. A. Rohwer. The condition looks abnormal, however, the third posterior having a broad, obliquely truncate base. There are two submarginals, and the fly is certainly not allied to either of the modern genera just cited.

7*b*. Discal cell closed.

9*a*. Only one submarginal cell.

10*a*. Second basal confluent with discal. *Glabellula* Bezzi. (N. Europe and Siberia.) Type of new subfamily Glabellulinæ.[1] *Mythicomyia*, a similar humpbacked genus, appears to be related, but is not so specialized or modified.

10*b*. Discal cell normal.......................... *Platypygus* Lw. (Palæarctic).

9*b*. Two submarginal cells.

11*a*. First posterior cell closed. (*Parabombylius* and *Amictus* have this cell nearly closed.)

12*a*. Anterior cross-vein far beyond middle of discal cell. *Anisotamia* Macq. A Lomatine genus, perhaps only a subgenus of *Oncodocera*. *A. ruficornis* occurs in Egypt; other species are found in Mexico and Guatemala.

12*b*. Anterior cross-vein before middle of discal cell. Bombyliine genera such as *Bombylius* L. and *Systœchus* Lw.; I have found no trace of this now dominant type in the Florissant shales.

11*b*. First posterior cell open.

13*a*. Anal cell closed. (In *Lithocosmus* so nearly closed that the genus may be sought here.)

14*a*. Second vein at end strongly recurved, its inner angle with costa obtuse; anterior cross vein very oblique. *Oncodocera* Macq. (Lomatiine flies of the Neotropical region and southern part of the Nearctic; some very large.)

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[1] Becker (Genera Bombyliidarum, 1913) places *Glabellula, Platypygus, Cyrtosia* and *Empidideicus* in a subfamily Cyrtosiinæ.

14*b*. Second vein not thus recurved, but more turned upward at end in *Lithocosmus* than in the living genera.

15*a*. Upper branch of third vein strongly curved and bent upward; anterior cross-vein a little before middle of discal cell.
Lithocosmus Ckll. (Miocene of Florissant).

15*b*. Upper branch of third vein not thus curved; anterior cross-vein a little beyond middle of discal cell. *Phthiria* Meig. and *Acreotrichus* Macq., genera living in North America. I figure *Acreotrichus atratus* Coq., Sierra Madre; from the type.

Lithocosmus appears to be more specialized than *Phthiria*, and cannot well be ancestral to it.

13*b*. Anal cell open. Very numerous genera, belonging to Bombyliinæ, Lomatiinæ and Toxophorinæ, run to this place in the key; I do not attempt to deal with them all. Resemblances in venation seem here to be due at least in part to convergence.

16*a*. Upper basal corner of second submarginal cell sharply rectangular, with an accessory nervure pointing basad.

17*a*. Second vein recurved at end, its inner angle with costa extremely obtuse.
Alepidophora Ckll.; *A. pealei* Ckll. (Florissant Miocene).

17*b*. Second vein reaching costa at about a right angle. *Epacmus* O. S.; *E. nebritus* Coq. (California) is figured from type. Curiously the fossil genus appears to have a more specialized second vein than the recent one.

16*b*. Upper basal corner of second submarginal cell not rectangular.

18*a*. Inner angle formed by second vein with costa acute.

19*a*. Anal cell nearly closed; second posterior with a broad base.

20*a*. Anterior cross-vein conspicuously oblique, near end of discal cell. *Corsomyza* Lw. (Baltic Amber), if the discal cell in this genus is really closed.

20*b*. Anterior cross-vein a little before middle of discal cell.
Lithocosmus Ckll. (Miocene of Florissant).

19*b*. Anal cell evidently open; in *Desmatomyia* strongly narrowed apically, but the second posterior cell is narrowed almost to a point at base.

21*a*. First posterior cell greatly narrowed or almost closed at end; anterior cross-vein far beyond middle of discal cell, as in *Corsomyza*. *Amictus* Wied (a Toxophorine genus, well developed in Northern Africa, Southern Europe and Turkestan).

21*b*. First posterior cell widely or evidently open, though it may be much narrower at apex than at base, as in *Metacosmus*. Anterior cross-vein sometimes beyond middle, but not near to end of discal cell.

22*a*. Second posterior cell broader than long. *Psiatholasius* Beck. (a Bombyliine genus from Tunis).

22*b*. Second posterior cell longer than broad.

23*a*. Second posterior cell narrowed almost to a point basally.
Desmatomyia Willist. (*D. anomala* Willist., Colorado).

23*b*. Second posterior cell broad at base.

24*a*. Second vein straight, as in *Toxophora*. *Eclimus* Lw. (a Toxophorine genus, well developed in the Nearctic region, and sparingly in the countries around the Mediterranean).

24*b*. Second vein strongly curved or sinuous.

25*a*. Second vein with a single curve; vein separating discal from third posterior cell

straight. *Dischistus* Lw. (a Bombyliine genus, well developed in the Palæarctic Region).

25*b*. Second vein with a double curve; vein separating discal from third posterior cell strongly curved or arched............*Metacosmus* Coq. (California).

18*b*. Inner angle formed by second vein with costa a right or obtuse angle.

26*a*. Anal cell extremely widely open, a little wider than the third posterior. *Verrallites* Ckll. (Miocene of Florissant; see Canadian Entomologist, July, 1913, p. 230).

26*b*. Anal cell not remarkable, but in *Lepidophora* only narrowly open.

27*a*. End of marginal cell level with beginning of second submarginal. *Legnotomyia* Bezzi, (a Bombyliine genus from Syria).

27*b*. End of marginal cell much beyond beginning of second submarginal.

28*a*. Anterior cross-vein at or before middle of discal cell.

29*a*. Discal cell very long and narrow. *Lepidophora* Westwood. (Neotropical and southern part of Nearctic Region.)

In *L. vetusta*, as figured by Williston, there is a band of pigment simulating the vein which goes from the second to the third vein in genera having three submarginal cells. It appears that the vein has disappeared, while the pigment has remained. *Lepidophora* certainly has two submarginals by the loss of a vein which is present in such other Toxophorines as *Cyllenia, Tomomyza* and *Toxophora*.

29*b*. Discal cell not long and narrow. *Aphœbantus* Lw., including *Triodites* O. S., (a Lomatiine genus, with one species in Algeria, and very many in California and adjacent regions).

28*b*. Anterior cross-vein much beyond middle of discal cell.

30*a*. Anterior cross-vein very oblique. *Lomatia* Meig. (type of Lomatiinæ; a genus well developed in the Palæarctic Region).

30*b*. Anterior cross-vein not very oblique. *Megacosmus* Ckll. (two species in Miocene of Florissant).

This fossil genus is very much like the living *Paracosmus* O. S., from California and Sonora. In the fossil genus the second vein is more recurved at end, and therefore more specialized, than in the recent one. The species of both genera differ among themselves in the details of the venation, and it is possible that future study will indicate that they are only subgenerically distinct. The species of *Megacosmus* are quite large flies, as the name indicates, while those of *Paracosmus* are small.

9*c*. Three submarginal cells.

31*a*. First posterior cell closed. *Pantarbes* O. S. (California, Arizona and Sonora) and *Triplasius* Lw. (California, Tunis, S. Africa).

31*b*. First posterior cell open.

32*a*. Base of upper apical submarginal cell apicad of base of lower apical s. m. cell; inner angle formed by second vein with costa an obtuse angle. *Amphicosmus* Coq. (California and Mexico).

32*b*. Base of upper apical submarginal cell level with base of lower apical s. m. cell.

33*a*. Anterior cross-vein before middle of discal cell. *Ploas* Latr., (a Bombyliine genus well developed in the Palæarctic Region and in California).

33*b*. Anterior cross-vein beyond middle of discal cell. *Lordotus* Lw. (Western U. S. and Mexico. I have taken it in New Mexico; *L. junceus* Coq. (det. Coq.) at flowers of *Pectis papposa*, Mesilla Park, Sept. 17; *L. diversus* Coq. by Tularosa Creek).

32*c*. Base of upper apical submarginal cell far basad of lower apical s. m. cell, base of the latter sharply truncate.

34*a*. Inner angle of second vein with costa a right angle or greater; anterior cross-vein far beyond middle of discal cell. *Cyllenia* Latr. (a Toxophorine genus of the Palæarctic Region).

34*b*. Inner angle of second vein with costa an acute angle.
Tomomyza Wied. (a Palæarctic Toxophorine genus) and *Exepacmus* Coq. (California).

Conclusions.

The following conclusions are not stated at all dogmatically, but represent the impressions gained from this study.

(1.) The Bombyliidæ are a rather ancient group, showing very little forward evolution since the Miocene, but rather miscellaneous shuffling of characters; while many genera have become extinct, and others, as shown by the discontinuous distribution, appear to be or to have been on the wane.

(2.) There is much duplication of venational characters in different groups, but rarely upon *exactly* the same lines. This phenomenon is better called *duplication* than *convergence*.

(3.) In certain venational characters, the Miocene fossils are not rarely more specialized than their nearest living allies.

(4.) The Anthracinæ, and probably also the group of genera clustering around *Bombylius*, seem to have arisen in the Old World; they probably reached America toward the end of the Miocene, and thereupon became dominant, the Anthracinæ producing many species, while the earlier Bombyliid fauna of North America became very much reduced, and is now represented by mere fragments. This parallels the history of the fishes of the family Cyprinidæ, in relation to the Catostomidæ &c , though the parallel is not exact.

This study may also throw some light on the mechanics of wing-venation, but this is a large and difficult subject, and its consideration is deferred.

List of Figures († = fossil).

1. *Acreotrichus atratus*. From types. Sierra Madre.
2. *Aldrichia ehrmanni*. From type.
†3. *Alepidophora pealei*.
4. *Amphicosmus elegans*. From type.
5. *Aphœbantus squamosus*. From type. Almost the same as *Epacmus*, in regard to the parts shown.
†6. *Corsomyza crassirostris*.

7. *Exepacmus johnsoni.* From type.
8. *Epacmus nebritus.* From type.

†9. *Geronites stigmalis.* Discal cell.

†10. *Lithocosmus coquilletti.*

†11. *Megacosmus mirandus.*

†12. *Melanderella glossalis.*

13. *Metacosmus exilis.* From type.

†14. *Pachysystropus rohweri.*

15. *Paracosmus insolens.* From type. A very small species. Venation in general agrees with that of *Metacosmus exilis*, but differences in apical field as shown in figures.

16. *Paracosmus morrisoni.* San Diego, California (Coquillett).

†17. *Pachysystropus condemnatus.*

18. *Triodites mus.* Discal cell and apex of wing.

19. *Toxophora virgata.* End of discal cell. This is not like Williston's figure; but *T. pellucida* agrees with Williston's figure. A *T. pellucida* from Arizona has the barest rudiment of the stump of vein which if complete would separate second and third posterior cells.

†20. *Verrallites cladurus.*

56.1,93(112)

Article XIX.—FURTHER NOTES ON OZARKIAN SEAWEEDS AND OÖLITES.[1]

By G. R. Wieland.

Plates XIV–XIX.

In July, 1825, there appeared in the 'American Journal of Science' an excellent article by J. H. Steele on the Oölites and certain remarkable concretions observed to accompany them in the limestones about Greenfield, Saratoga County, New York. In fact this short paper was a really notable contribution. For its clear record of the occurrence of the oölites and cherts in the mid-Ozarkian formation now called the Saratogan is not only the first definite notice of American oölites but one of the earliest of all references to the oölitic horizons of the Paleozoic; while the large "concretions" of which there is given a very good figure showing both outer form and mode of occurrence, are but little different from the long problematic fossils described without reference to Steele's earlier notice nearly sixty years later by James Hall as *Cryptozoön proliferum* (2). Still more recently similar isolated bulky turbinate types from the St. Peter sandstone of Minnesota have been named *Cryptozoön minnesotense* by Winchell (3), and a somewhat more lenticular form of the Shakopie limestone is called *Cryptozoön giganteum* by Chaney (18). Yet other species are those of Dawson (16) and Seely (23), amongst them being *Cryptozoön steeli.*

Although the lapse of eighty-eight years has added much to our knowledge of the two subjects of Steele's paper, *Cryptozoön* still remains a little known form, while the origin of the oölites is a subject of keen controversy, a problem as difficult as it is interesting. We have, therefore, not passed by the time when these seemingly remote subjects need necessarily be dissociated. *Cryptozoön* and the cherts, calcareous and siliceous oölites are notable features of the Ozarkian, ever recurring together in the field as objects of widening geologic interest. And it may yet prove that aside from mere historic perspective Cambrian and later shore conditions justify a sequel to the contribution of Steele. Accordingly, in the present paper we briefly consider the evidence now going to show that *Cryptozoön* belongs to a group of Algæ which formed vast reefs in the Ozarkian oceans, and also

[1] See list of authors cited in chronologic order at the end of this article and referred to in the text by parenthetic numbers, or by dates.

describe from the Conococheague of Pennsylvania a new species, likewise of the reef-making type, going to prove that the hypothetical "age of seaweeds" preceding the coal plants was a reality. Following which there are subjoined remarks on the origin of the more closely associated oölites.

I. Silicified Seaweeds of the Conococheague.[1]

Text Figs. 1 and 2 and Plates XIV–XVIII showing a huge new silicified type.

Fully as interesting as the oölites of the Cambrian and Ordovician, and quite as problematic until now, are the huge fossils from Centre County, Pennsylvania, of the type shown in text Figs. 1 and 2 and Plates XIV–XVIII. These new forms occur closely associated with fine grained oölites of the lowermost Conococheague, Stose (28), and would in any case be well worthy of record because belonging to a series in part collected over forty years ago near locality A in Ziegler's map (31). At this point these silicified seaweeds, together with some siliceous oölite and numerous flinty boulders not distinctly granular or cherty, weather out from the underlying limestones which although markedly siliceous are yet soluble enough to be subject to cavern honeycombing on an extensive scale. Drainage, as numerous sinkholes and ponds plainly show, has in the course of time become subterranean, and it is here that trident-like three considerable swales unite to form the main branch of the old cavern-robbed stream course known as the "Big Hollow."

The seaweeds of the new type before us are not as yet known to be abundant,— doubtless because the Centre County Conococheague mainly traverses the borders of the wooded "Chestnut Ridge" country and a systematic search along the outcrop has never been made. Such will doubtless reveal points where these striking fossils are more numerous. So far about a dozen specimens weighing from one to three hundred pounds are all that have been collected. But these are mostly from one point, and from their great size and the fair inference of abundance it is quite certain that they are, like the other Cryptozoöns, a reef-forming type. Other specimens have been seen one mile southwesterly.

It is curious to find that despite the wide occurrence and great abundance of the problematic fossils of the *Cryptozoön* group such large silicified forms as these before us have not often been reported. Yet there appears to be but

[1] A brief *résumé* of the facts and conclusions here presented concerning ancient algal life was given at the December, 1912, meeting of the Paleontological Society of America at New Haven in conjunction with an exhibit of representative specimens and sections.

little doubt that these specimens represent a distinct and unnamed species. Accordingly without raising larger questions of classification and generic relationship which I leave to those more familiar with hydrozoan, coral and seaweed structure than myself, I shall take the liberty of naming this new form after Professor R. S. Bassler of the U. S. Geological Survey, giving the brief analysis here appended.

Cryptozoön *Hall,* 1883.

This genus as established by Hall contained the single species *C. proliferum,* nearly identical as already remarked with the concretionary masses figured by Steele. But later studies render it certain that *Cryptozoön* is well represented by species, and belongs to a family of mostly calcareous seaweeds widely distributed in the Paleozoic.[1] Winchell (3) and Chaney (8) have reported huge Cryptozoöns from Minnesota. Dawson (16) added several species of lesser size, and others were named by Seely (23) and by Walcott.

Further, the studies of Rothpletz (25) show *Girvanella* of Nicholson (7) to be a calcareous seaweed, and it is now obvious that this genus is closely related to *Cryptozoön.* While but very recently the allied Asiatic genera *Metasolenopora* and *Petrophyton* have been established by Yabe (29). Although only critical study as yet difficult to make can finally serve to separate these several genera from the Stromatoporoids they clearly constitute an important and homogeneous assemblage passing from minute pseudolitic species like *Girvanella sinensis* Yabe up to the most gigantic of seaweeds fully characterizing their age.[2]

Cryptozoön bassleri sp. nov.

Text Figs. 1 and 2 and Plates XIV–XVIII.

Material.— A series of immense crescentiform segments weathering from the Upper Conococheague of Centre County, Pennsylvania, two and a quarter miles N. N. W. of the Pennsylvania State College. The type series aggregating a ton or over in weight is entirely from the W. F. Wieland farm.

[1] The possibility that some of these species had their tissues impregnated with silica more as in the case of the brown seaweeds has never been suggested, but should not be excluded, especially in the case of the forms before us.

[2] Only after the present study was prepared for publication did the presidential address of Garwood come to the writer's knowledge. (See Nature, Sept. 25, 1913). In developing his investigations Professor Garwood has followed lines nearly parallel to those here followed, and reaches essentially the same conclusions here set forth as to the important rôle played by the sea weeds in geologic time.

The specimens were first collected by the writer's father, W. F. Wieland, about 1870, later by the writer and his brothers, and were mistakenly figured as inorganic in the American Journal of Science, Vol. IV, 1897, p. 263. The larger forms indicate fossils that if found complete would weigh a ton, or much more.

Description.— The free thalli of *C. bassleri* grew in large open circles or crescents, or the recovered portions may have been more or less tangential to radiate outgrowths from a central mass, the separate individuals often crowding each other. Since only outer segments of thalli lacking a proximal

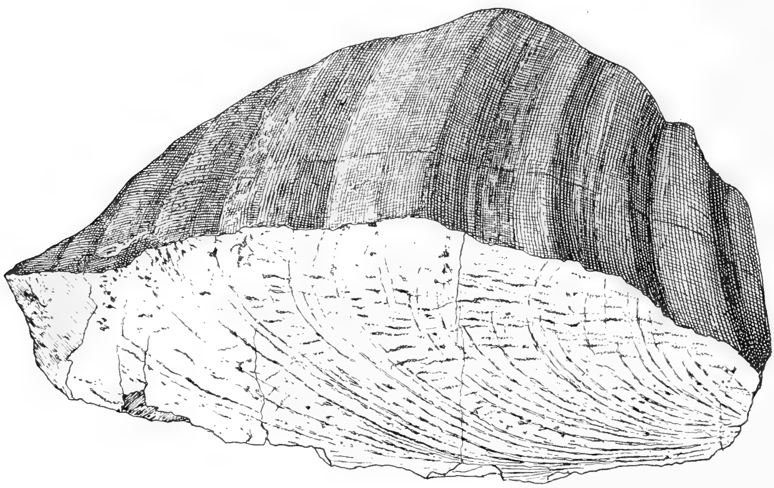

Fig. 1. *Cryptozoön bassleri.* Drawing which shows the laminar markings of the vertical transverse section but fails to bring out the secondary furrowing and the pitting of the superior surface. × ¼. Lower Ozarkian near Pennsylvania State College, Centre County, Pennsylvania.

insertion have been seen the form of the entire fossil is unknown. But as transverse sections are always much alike, it is at least evident that the plant was of distinctly squamous habit with more or less linear sessile attachment of the primary leaf and subsequent increase in size by a more or less irregular false dichotomy of the new laminæ due to nether suppression of growth. The finer features of our fossil are not conserved, it being a siliceous cast, with only rare instances of indistinct traces of cells traversing the leaves.[1] But it cannot be doubted that the cell structure was of essen-

[1] Of course it is improbable that these Cryptozoöns were gigantic silica secreting types instead of calcareous. Whence in suggesting that they were primarily silicified the replacement of organic lime (arragonite) is still involved. The question is as to the time of mineralization, whether *early* as I believe or late. That the fine structure fails is not in itself evidence

tially the same highly palisaded *Lithothamnion* type Rothpletz (6, 25) and Yabe (29) have figured and described in various well conserved species of *Girvanella,* etc. Along with this structure probably goes the partial preservation of a finer lineation which as well shown by Yabe in *Petrophyton* may be formed by the very regularly palisaded cells with thickened ends. In

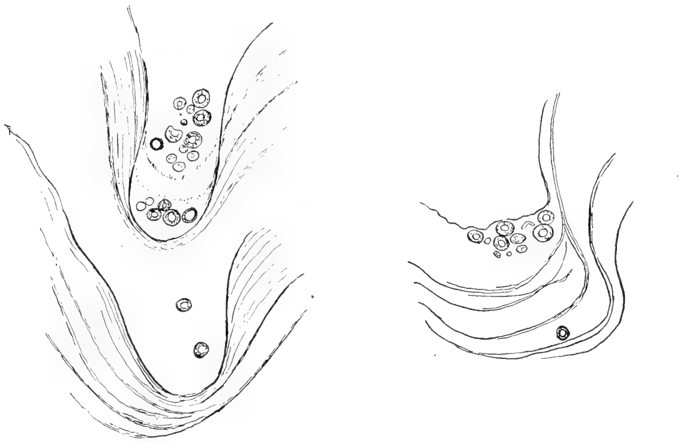

Fig. 2. *Cryptozoön proliferum* of the Beekmantown. Collected by Ziegler near Scotia, Centre Co., Pennsylvania. Transverse section through conceptacles (?) containing supposed spore cases, some of which are more or less imbedded by growth as in certain *Lithothamnium* species. Camera lucida drawing. × 10.

consequence the limits of the individual and evidently freely perforate leaves are rather difficult to make out, the borders or surfaces often having an appearance as of solid textures; so that it is more convenient to speak of laminæ than of the actual leaves or congeries of branches. For the fuller

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of later replacement, since the allied calcified forms show precisely the same structureless type of fossilization.

The occurrence of structureless siliceous casts of lime bearing organisms ordinarily found calcareous with all structures conserved does of course show that siliceous casts are often secondary. Thus Etheridge describes considerable portions of the skeleton of a Sauropterygian (*Cimiliosaurus*) as converted into precious opal (Records of Australian Museum, Vol. III, No. 2, 1897). But contrariwise specimens of chalcedonized wood vary all the way from perfect preservation to forms retaining but the faintest traces of growth rings and medullary rays. One such containing imbedded crystals of selenite varying from small up to several centimeters long I collected on Crystal Mountain in the Yellowstone Park and find hard to explain, but think was initially silicified in the absence of sufficient iron to stain the cell walls, and at too rapid a rate to favor structure conservation. It may at least be concluded from these general facts that caution is required in adjudging many structureless siliceous casts as simply replacements of earlier calcareous casts with their histologic structure conserved.

Furthermore down to the present hour insufficient attention has been given the silica series in its relation to lime as an organic and skeletal constituent. I find little information anywhere on the important question as to whether invertebrates habitually use all silica, or all lime, or as in higher organisms to some extent employ both these elements to build up the body.

conception of other than macroscopic details therefore, the reader must, in conjunction with a review of the structure of the simpler seaweed types, consult the papers of Rothpletz (6, 25), Ruedemann (27, 29a), and Yabe (29).

This lack of the finer structures does not however prevent a fairly satisfactory comparison with other species. The American fossils thus far referred to the genus *Cryptozoön,* omitting reference to *Stromatocerium Solenopora* and the various Stromatoporoids — those more debatable forms with the tubule systems — are the following: —

1883.	*Cryptozoön*	*proliferum* Hall.
1891.	"	*giganteum* Chaney.
1892.	"	*minnesotense* Winchell.
1897.	"	*boreale* Dawson.
1897.	"	*lachutense* Dawson.
1897.	"	*occidentale* Dawson.
1906.	"	*steeli* Seely.
1906.	"	*saxiroseum* Seely.
1906.	"	*wingi* Seely.
1906.	"	*frequens* Wallcott.

As already mentioned all the known types differ from our form in having a far more distinctly circular to turbinate habit of growth. Doubtless the species primarily to be compared is *C. proliferum.* But this type is according to Hall often turbinate, strikingly so in a specimen from Saratoga County recently acquired by the writer. So also the *C. minnesotense* where isolated or weathering free from the matrix; while the Steele specimens have the same character somewhat accentuated. It follows that our own specimens, the terminal thalli of which are of decidedly open habit of growth, or were at times nearly linear in form and have a flat basal surface, differ too broadly from either of the foregoing to be explained away as a growth variation due merely to local shore conditions or to situation.[1]

It appears too that compared with older specimens of *Cryptozoön proliferum* there is less crenulation of the laminæ, at least as they emerge on the upper thallial surface, so that the emergent congeries of laminæ produce a more regular ridging. That the lesser bud-like and probably young forms evident in Hall's figures and strikingly present in the *Cryptozoön* ledge

[1] The remarkable freedom of these huge fossil seaweeds from either crushing or recemented fractures is one of their most striking features, and suggests original silicification rather than siliceous replacement of an imbedded calcareous fossil. In the latter case there should be occasional evidences of the infiltration of silica into previously fractured structures but none are found, although the laminæ were rarely faulted with some recementing after silicification.

shown by Professor Bassler's photographs (Plate XIX) also accompany the silicified forms is however likely. A cavity on the lower surface of the largest segment recovered may have been occupied by just such a lesser form. But further than this, comparisons cannot be carried until specimens with structure conserved are found, and a series of large polished surfaces of *Cryptozoön proliferum* comparable to that made from the Pennsylvania Cryptozoöns for these studies is available to show in addition to general form if the same false dichotomy of the laminæ rules. That the fine structure of the Pennsylvania specimens must agree very nearly with that of *C. proliferum* is however certain.

On turning to secondary features one notes a very interesting habitus variation from the next most closely allied species, the *Cryptozoön giganteum* of Chaney (8). This plant also reaches enormous size, and from the short but excellent paper of Chaney it appears that the laminæ in rising from the main prostrate branch took on a distinctly overthrust growth so that the free edges formed a nearly vertical instead of flat outer surface, while the mass was far more hemispherical or lens-like than in our specimens. At least this is the interpretation of form and structure one may reach if a slight modification of Chaney's figures be permitted, these not showing or not accounting for the false dichotomy of the laminæ.

Regarding the interpretation of the very large convex lens-like or dome-shaped Shakopee aggregates observed to reach as much as ten feet in diameter by four in height, I am quite in accord with Chaney (8). He noted that it was difficult to observe how far from the center the *Cryptozoön*-like structure extended, and thought a large portion of the outer mass might be a continuation of the laminæ of the fossil as an inorganic foliation, or exfoliation of the surrounding matrix due to the course of imbedding and fossilization. This we consider the explanation nearest at hand, and in a slightly different manner well illustrated by the remarkable wheel-like burr-stone concretionary masses enveloping either the cycads or especially the rooted stumps of the coniferous trees which form such a striking sight as they weather out of the highly inclined strata of the "Portland dirt bed" outcrop on the coast of the Isle of Purbeck to the east of Lulworth Cove.

A searching generic definition is doubtless uncalled for because difficult to give; although if the forms figured herewith are not yet found to fall within *Stromatocerium* and are to be finally included in the genus *Cryptozoön* (instead of being called by what would be a far more appropriate generic term [*Cryptophycus*] to which I ask the attention of paleontologists) some extension of characters is necessary. For, while all the larger types described by successive authors from Steele to the present day are characteristically hemispheric to turbinate, the seaweeds before us must as al-

ready noted have been of slightly curved to strongly crescentric form, with a flat rather than convex base, and a far more regularly furrowed upper surface than is seen in other *Cryptozoön* species. But it should be specially recalled that as the thallial insertion has not been seen, it is quite possible that instead of a distinctly linear attachment to the sea-bottom the entire organism was initially turbinate. If so free peripheral or tangential outgrowth of the thalli from a central holdfast or turbinate mass resulted in gigantic subasteriate forms of magnificent appearance and size (*cf.* legend of Plate XVIII.)

Fruit Conceptacles of Cryptozoön proliferum.

Text Fig. 2.

In the preceding description of the silicified specimens of *Cryptozoön bassleri,* an algal nature has been assumed because there is unquestioned specific relationship to *Cryptozoön proliferum,* the fruiting of which is probably determined. At least in a calcified specimen collected by Ziegler in the Beekmantown north of Scotia (*cf.* Map in ref. 31) and kindly given to me for study, I find numerous oögonia-like spherules in regularly aligned pockets formed by the lamellæ in a manner strongly resembling systems of fertile conceptacles, as shown in Fig. 2, page 241. Others of the spherules or pseudolites, it is true, are found outside the pockets, and are sometimes imbedded as in old pockets, but the entire appearance suggests growth of the spherules in the pockets with a later pouring out of the matured fruits from between branches or through the lamellar perforations into the interlamellar spaces.[1] Moreover these spherules have exactly the size of certain algal oögonia of the Devonian and while not showing a structure conclusively organic, do not present the wide variation in the concentric zones seen in most older oölites. Moreover various of the grains show very distinct traces of radial cell walls in the outer test, as it may be called, and there is a uniform absence of nuclear grains of variant size and shape generally characteristic of oölites, the large central space appearing on the contrary to be in all cases secondarily filled. I therefore expect to see the view that we here have

[1] With respect to these features it may be noted that excellent descriptions of the luxuriant arctic species of *Lithothamnium* are to be found in Kjellman's *Algae of the Arctic Sea* (Köngl. Sv. vet. Ak. Handl., Band 20, No. 5). And it is of direct interest that on page 94 of this work the interesting fact is recorded that on the fractured surfaces of *Lithothamnium glaciale,* the large hemispherical to spherical species reaching 15 to 20 centimeters in diameter, old conceptacles of sporangia are found grown over, a condition which appears to be repeated in our fossil.

fruit-containing conceptacles confirmed by other and better conserved specimens, or at least by frequency of observation.

It is of some weight to recall that higher types of algæ were already developed in the Devonian. The genus *Chara* certainly goes back to the Corniferous as determined by Knowlton from specimens of distinctly sphericiform oögonia collected at the Falls of the Ohio and since figured in paleobotanic texts (20). And that such *Chara* forms are of wide Upper Devonian range is conclusively proven by a further group of beautifully sculptured oögonia gathered from the Hamilton shales on Snyder Creek, Calloway County, Missouri and about a dozen years ago placed in my hands by Professor C. E. Beecher. These spore-cases only differ from the Corniferous specimens in their lesser size, a length of five millimeters being taken up by eight oögonia placed side by side. Taken along with the Knowlton oögonia which were simply ascribed to the genus *Chara,* they constitute a valid unnamed species differing in size and sculpturing from other fossil forms (*cf.* ref. 20, fig. 46) and most conveniently recorded as **Chara devonica.**

It is perhaps a mere coincidence that the oblong oögonia of the existing *Chara fœtida,* the rounded Devonian forms, and the supposed spore-bodies of *Cryptozoön proliferum* figured herewith, are all of the same size. But it helps call attention to the fact that by suppression of the spiral grooves of the *Chara devonica* oögonia the rounded pseudolitic form would result. Again *Chara* antheridia are spherical, and the possibility that the *Cryptozoön proliferum* conceptacles were bisporangiate is by no means excluded.

That grains of oölite might often be found accompanying such specimens is to be sure not only possible, but probable. Every circumstance in the life of these plants, bearing in mind the great range of temperature the algæ endure and the possible variations in growth processes in a remote geologic period easily conceived of as chemically active far beyond later ages, suggests the conditions theoretically favoring oölite formation, even did we not know how frequently the oölites recur in ever varying forms in the *Cryptozoön* horizons. Nevertheless a mere outer resemblance to oölite in the grains found between the laminæ is not conclusive evidence. And the more must be questioned the view of James Hall, who also observed these grains, that they are oölite derived from or formed on the outside of the organism because greater in quantity towards the edges of the outer laminæ. Not only must the conceptacles be more abundant there, but the opposite interpretation at once comes to mind. For as the conceptacles matured their fruits it may be assumed as certain that some accelerative force, whether of water or gravity, combined with laminar movement tended to carry the swarms of oögonia out continually. While any weighting down due to

incipient mineralization might hold the oögonia in great numbers near the outer laminar fringes. A study of thin sections taken from examples *in situ* will doubtless later yield the desired confirmatory evidence. Certainly typical *Chara* oögonia are frequent fossils in the later rocks. Thus Mantell in his Geology of the Isle of Wight (p. 78) mentions limestone blocks on the shores of Whitecliff Bay in which the *Chara* fruits are "so numerous as to constitute a large proportion of the mass." Moreover it is entirely possible that certain strata of the Paleozoic rocks described as oölitic are in reality great banks of oögonia comparable to the accumulations of coal plant spores which as first proven by Jeffrey make up cannel coal strata reaching as much as two meters in thickness. Indeed Van Ingen has called my attention to one of these supposed oögonia banks in the Devonian of Kelly's Island, Lake Erie, and it is undoubtedly true of all oölites ancient and modern that an organic origin whether direct or indirect is the first presumption in the absence of positive proof to the contrary.

Obviously the point of greater interest in the foregoing description is as to the true nature of the silicified and other gigantic reef-forming fossils of the Ozarkian, which, with *Cryptozoön proliferum* Hall, *Girvanella* and a long list of associated or closely allied *problematica* were an ever present feature of the early Paleozoic shallow waters and shore lines. For it is now believed that at least all those forms once included amongst the Stromatoporoids, which lack a tubule system with corresponding surface pustulations and are in great part of characteristically laminate, linear, or much branched *Lithothamnium* form, are all primitive algæ which form the abundant record of a far more luxuriant seaweed growth than has hitherto been understood to have characterized the Paleozoic.[1] In fact the data accumulated by various workers during the past fifteen years go far to indicate that preceding early terrestrial plant life there was an "*age of algæ*" in every respect characteristic.

If on the one hand the time-honored custom of calling all older *problematica* and unusual rock markings seaweeds has been abandoned, on the other, Rothpletz, White, Ruedemann and others are very correct in pointing out that from the small number of ancient forms actually demonstrated to be of algal nature we thus far get no criterion of the real abundance of seaweeds in the Paleozoic.

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[1] That many of the Stromatoporoids like *Labechia* and certainly *Solenopora* may also eventually be found to fall within an older seaweed series of far more varied aspect than has as yet been conceived to have existed, is a highly interesting suggestion recently made to me by Professor Parks. Frankly stated, it is a fact that neither zoologists nor botanists are as yet able to define in even the broadest terms the boundary between the primitive seaweeds and the older hydroids or coralloids. [But see Professor Garwood's address, ref. 34.]

But the evidence of this varied algal life in the early Paleozoic is no longer scant. Ruedemann (29a), whose studies have especially qualified him for the recognition of the older fossil seaweeds, has within the past year found a great quantity of finely preserved algal forms in the new fossil localities of the Schnectady shales. And the Lower Silurian seaweeds have seldom been so well figured as are these forms in part referred to a new genus *Sphenophycus*.

Chapman and Mawson (24) have shown the importance of the coralline alga *Halimeda* as a reef maker in their description of the *Halimeda* limestones of the New Hebrides proving how effective a rock builder this form may become. And Brown (33) has recorded the principal facts concerning certain pebble beds of peculiar occurrence and wide distribution in the Paleozoic rocks of Centre County, Pennsylvania, reaching the conclusion that the pebbles which show traces of a laminiform structure and are often siliceous are the fossil remains of some gigantic *Halimeda*-like form. These hypothetic fossil algæ extend from the Cambrian into the Ordovician and are said to make up a large proportion of the first few hundred feet of the Beekmantown, *Cryptozoön* being frequently associated. The latter, as I have been told by C. J. Sarle, furthermore, occurs in some new specific, if not generic variation, distributed throughout fifteen hundred feet of the Carboniferous rocks of southwestern Texas in noteworthy abundance, often forming huge reefs that must have extended mile-wide. Also, Blackwelder reports that in the Ordovician of the Northwest, limestones some thousands of feet in thickness are mainly made up of peculiar structureless masses producing odd erosion forms and best explained as due to vast aggregations of coralline algæ. Whilst the presence of the bulky algoid form called *Cryptozoön frequens* by Walcott throughout full ten or twelve thousand feet of the great development of Algonkian in Northwestern Montana is doubtless the most striking and best attested example of the mode of occurrence and vast extent of the *Cryptozoön* reefs in the older rocks (24a). So striking indeed are these occurrences that it is necessary to infer the absence of *Cryptozoön* in many Cambrian and Ordovician terranes of the Rocky Mountains as quite probably due to lack of conditions favorable to preservation.

Taking these facts into account there appears to be sufficient ground for modifying the outline of plant development in geologic time long since given by Brongniart as follows:[1]

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[1] In giving this new outline I avail myself of yet other studies, which indicate that so far nearly all the general outlines of ancient plant life have not taken into full account the extreme antiquity of gymnospermous seeds and woods of high organization and cosmopolitan distribution. While all recent study has given us a greatly changed conception of the alignment of Mesozoic plants.

I Reign of Primitive Life (Hypothetic)	Oldest Precambrian
II Reign of Algæ	Precambrian Cambrian Ordovician
III Reign of Gymnosperms	Silurian (?) Devonian
IV Reign of Acrogens	Carboniferous Permian
V Reign of Proangiosperms	Triassic Jurassic
VI Reign of Angiosperms	Cretaceous Tertiary

In short, then, without going on into the inevitable reconsideration of *Eozoön* as a presumably algal form which Dawson long since *figured and described as a large turbiniform type,* or taking up any other fossils than those quite certainly algal, it becomes clear enough that so long as the older seaweeds remained wholly undifferentiated from the Stromatoporoids their true abundance largely escaped attention. The records of *problematica* are assembled but slowly. And as such the Paleozoic seaweeds find little mention from which might be inferred the extraordinary rôle they surely played. Nevertheless it becomes obvious that the further study of the older Paleozoic terranes will bring to light not only an abundance but a variety of algal life such as could not be inferred from the meager and occasional references in geologic literature to forms merely recorded as *problematica,* or without proof described as algæ. Nor does it even seem too much to say that no dominant organisms of later ages whether plant or animal ever exceeded the Paleozoic seaweeds as rock-forming agents or left a bulkier record. We now pass on to a brief discussion of the siliceous oölites so closely associated with the seaweeds and forming like them a most distinctive feature of the Cambrian and Ordovician rocks.

II. Conococheague Oölites. (Plate XVIII, fig. 2.)

The siliceous oölites of principal record are mainly from the American Paleozoic of Pennsylvania, Tennessee, Kentucky, Missouri and Canada. But contrary to the impression prevailing nearly to the present time this rock is rather common in older Paleozoic horizons the world over and occurs in a great variety of forms ranging through granular cherts hardly distinguishable from sandstone to rarely beautiful concretionary quartzites.

In fact it is precisely this marked gradation which has led some writers to speak only of cherts, and others only of oölites, thus easily leading to the impression of a somewhat restricted occurrence — an impression added to by the fact that the Jurassic oölites are so largely algal or pseudolitic and European, while conversely the main bodies of siliceous oölite are Paleozoic and American.

The first definite reference to these American oölites is clearly that of Steele as already mentioned; while ten years later in Featherstonhaugh's report of 1835, (p. 27) certain oölites "of the Carboniferous of the State of Missouri" are spoken of *as entirely converted into silica* like the Bristol, England, oölites. The occurrence of calcareous, but not siliceous oölites or cherts in Tennessee is also noted. And one year later, as quoted H. D. Rogers called attention to the oölitic cherts of Centre County, Pennsylvania as an unusual loose rock type; though on rapidly scanning his first Pennsylvania Report and also his two later bulky volumes I fail to verify any clear reference to concretionary structures.

The American oölites of the Paleozoic received but scant notice in the geologic literature of the subsequent fifty years. In the reports of Sir William Logan from 1860 on there are however occasional references to the cherts which grade over into the siliceous oölites of markedly concentric structure, and it is strongly inferred that such rocks may result from direct chemical deposition.[1]

Still later, various notes on the occurrence of the Missouri "siliceous oölites" and oölitic cherts are found in Broadhead's 1873–4 Report; though in Safford's Geology of Tennessee (1869) the only oölites mentioned are calcareous.

In fact, it is quite fair to say that the later and adequate study of the older oölites was not fairly begun until about 1890 or a few years earlier when the present writer brought the attention of petrographers to the handsome siliceous oölites of Centre County, Pennsylvania, locating at about the same time the occurrence of an Ordovician outcrop of siliceo-calcareous oölites on the Pennsylvania State College grounds, and later noting the interesting types of siliceous oölites occurring in the Knox terranes near Rockwood, Tennessee, both as imbedded boulders and stratified.

A siliceous "oölyte float" had been noted in 1884 by A. L. Ewing in

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[1] Logan also briefly mentions a partly silicified *Stromatopora* (Rep. Geol. Sur. of Canada for 1863, p. 630) and seems scarcely to question either its original silicification or the direct deposition of cherts, citing the then new experiments of Church (Proc. Chem. Soc. of London, Feb., 1862, also Phil. Mag. (4) XXIII, p. 95). Church showed that when a solution of silica in about 100 parts of water containing at the same time carbonic acid is filtered through fragments of coral, the whole of the silica is taken up by the coral while a large part of the carbonate of lime is dissolved. Shells behave in a somewhat similar manner.

D'Invilliers' report of the 2nd Pennsylvania Geological Survey (Centre County, Appendix B, p. 406). But no further facts were given, and the Centre County oölites did not become a subject of definite record in Geologic literature until in 1889 when I found a previously unobserved series of large surface boulders near the edge of the wooded Cambrian terranes locally termed the "Barrens" to the north of the Pennsylvania State College. These boulders weighing up to 400 pounds, were found approximately *in situ* at the locality where this rock was much later located in place in railroad cuts by Anderson and Ziegler (31), and undoubtedly furnished the first clear and unweathered specimens ever obtained of this handsomest of known oölites.

Study of this new material resulted in descriptive papers by Barbour and Torrey (4), Hovey (11, 13), Bergt (9), and myself (5). In 1890 Barbour and Torrey gave figures of two of the oölites with analyses, reaching the conclusion that the siliceous oölites must be pseudomorphic [because transition oölites I found outcropping in the Ordovician of the Campus of the Pennsylvania State College included a lime-silica and silica-lime form].

This was really a return to the early replacement idea that seems to have had little more basis than that inasmuch as the better known oölites of the Mesozoic were calcareous, siliceous oölites of the Paleozoic must be secondary, just as the siliceous casts of organisms once containing lime were readily regarded as always pseudomorphic, an idea known to be untenable ever since the actual silicification of corals by Church in 1860. (*Cf.* footnote, page 249.)

Bergt in 1892, however, added an extended description of the siliceous forms with more accurate analyses than those of Barbour and Torrey, studying the rock in polarized light and giving a number of figures. His work gives the German records on oölites, in particular the siliceous pisolite of Egypt, brought to notice in 1851, by Kengott and a siliceous oölite with 1.50% of titanium oxide studied by Knop. Bergt for the first time argued clearly that the siliceous oölite was formed by direct deposition, in a manner analogous to the calcareous oölites, and supposed it probable that geyser-like springs or other thermal waters may have afforded the silica.

Hovey in 1893 gave a figure of a far more recent siliceous oölite from the Tertiary of New Jersey, and in studying the Pennsylvania types independently of Bergt, also reached the conclusion that the rock was due to direct chemical deposition, a view with which I concurred in a paper published in the American Journal of Science for 1897, giving a further chemical analysis of the finest of the Pennsylvania forms and the only recorded analyses of the Tennessee oölites. But the most important early contribution to the general subject of the oölites and cherts is unquestionably a second paper

by Hovey in the same Journal on the Cherts of Missouri. Supplementary to Bergt, in this contribution, references to the work of Prestwich and other English writers are found, the facts adduced all going to show direct deposition of the oölites.

The next stage in the investigation of these oölites begins with the recent papers of Moore, Ziegler (31), and Brown (33). In a paper read before the British Association at the Portsmouth meeting in 1911 Moore (30) recorded the locating of numerous thin bands of oölite at the old "Barrens" locality similar to those I had earlier noted in Tennessee, and very briefly discussed their origin returning to the view or surmise of Barbour and Torrey that the siliceous oölites all originated by replacement of calcareous forms.[1]

The contribution of Ziegler (31) in the 'American Journal of Science' gives the first adequate field notes for the occurrence of the Centre County oölites. Following the best field work so far done on the oölites, he returns to the syngenetic view of direct deposition, giving a discussion of the possible effect of alternating alkalinity and acidity on lime and silica deposition, and rendering a solid contribution to the subject in hand. This work again carries us back to the views of chert and flint deposition held by Bergt and Hovey and found in the writings of Logan and Prestwich following the fundamental experiments of Church in silicification of corals, as well as in the work of Hinde and Van Hise.

In the still more recent paper of Brown (33) the siliceous oölites once more come up for mention and an interesting review of the observations and studies of the theory of oölite origin by Rothpletz and Linck is given,

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[1] These latter authors had observed two varieties in the Ordovician oölites I sent them from the Pennsylvania State College grounds, a lime-silica oölite with a radial, and a silica-lime oölite of a more markedly concentric structure. From which it was argued that while there are "indications of a different mode of formation it seems probable that the siliceous oölite (of lower horizons) is derived from the calcareous by the replacement of lime particles by silica." This is all Barbour and Torrey say in defense of their explanation, but Moore in subscribing to it adds that he finds some calcite about sand grains when present, and in other grains (of Cambrian oölites) outer rings of calcite. To these observations may of course be added my own determination that the Knox oölite stratum twenty feet in thickness near Rockwood Landing, Tennessee, consists in siliceous spherules imbedded in a gangue of dolomite. But a little higher up clear siliceous oölite boulders of large size lay imbedded in the dolomite just as might any siliceous nodule directly deposited as such.

Assuredly there are two ways to arbitrarily interpret such evidence. And similarly, the "*field method*" may fail when the attempt is made to explain sources and movements of silica available for the needs of those who believe in invariable replacement. Thus Moore observes that:—"In the (Cambrian) sandstone there are numerous examples of a partial solution of sand grains and the movement of the silica along cracks in the rocks, where grains are found partially dissolved and the material *redeposited* in a granular condition." The italics are mine. Observe that there is simply a deposition of silica in a granular condition, just as there might be direct deposition in an amorphous, botryoidal, lamellar or crystaline condition. And so far as evidence to the contrary goes have we not equal reason to believe that silica can also be directly deposited as a true oölite, and was more generally so deposited in the Cambrian and Ordovician than in later periods?

this author nevertheless fully convincing himself "that the material in his possession" will finally go to show that all the siliceous oölites are pseudomorphic.

From examination of the literature and study of the oölites it becomes evident that neither at the present time, nor at any time during the fifty years which have elapsed since the laboratory work of Church, nor yet in the case of the students of any country, has there been unanimity of view on the origin of oölites. And in the main one readily reaches the conclusion that the advocates of a general pseudomorphic origin have not displaced by evidence rather than contention the opposed syngenetic view according to which oölite origins are complex, and involve the direct accretion of both lime and silica, the subsequent replacements being occasional rather than universal phenomena.

Also Hovey's paper on the cherts of Missouri (13) has been somewhat neglected by the students of the past few years; to say nothing of the clear statement of Clarke in his discussion of these cherts and oölites (Geochemistry, pp. 518–520) that " no one process can account for all the occurrences of cryptocrystalline silica." Though if the cherts of Missouri and the oölites of Pennsylvania afford a criterion we have not yet reached the point where "local study" will necessarily result in similarity of view.

It would seem that the very fundamental experimentation of Church in showing sixty years ago that corals could be silicified indirectly suggests some of the conditions requisite to the artificial production of oölites. At least there are no recent observations which by themselves need compel us to disbelieve the possibility of direct deposition of many of the cherty and oölitic quartzites of the older formations, certainly not in the absence of laboratory studies going to prove that silica has no cryptocrystalline properties analogous to those of calcite,[1] and that hyalite, for instance, has no semblance to oölite.

That only definite chemico-physical studies and new discoveries can suffice to fully solve the oölite problem now seems clear. But some real advance along these lines has been made. Vaughan (32) in his study of the muds of the Dry Tortugas and the Marquesas Lagoon, has recently confirmed the observation of Linck that a peripheral deposition of lime on

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[1] The oldest siliceous oölite of which I have been able to learn occurs stratified in the "Animike" shales of Port Arthur at the west end of Lake Superior. These shales are of Upper Pre-Cambrian age. As described by Coleman (Geol. Surv. of Canada) the spherules vary from small forms up to large pisolites.

One of the most curious of oölite structures is the pisolitic limonite of Tern, New Zealand. The spherules vary from small sizes up to 2 centimeters in diameter, 1 centimeter being an average size. This is strictly a form of direct deposition analogous to a somewhat similar siliceous pisolite from the Yellowstone Park, where arragonitic pisolites likewise recently formed also occur.

embedded gas bubbles with or without solid nuclei, may explain the origin of some oölites, it being found that the gas can escape without rupture of the initial layer. While still later (35) this observer ascribes the origin of the Floridian and Bahama plateau oölites to the direct precipitation of arragonite by devitrifying bacteria. Accretion of spherules continues to go on in the sample alkaline solutions from the waters where oölite is today in process of formation. And very obviously if in recent seas with abundance of calcareous slimes such processes readily go on in the case of calcium carbonate, the question at once presents itself whether siliceous oölites may not form by analogous processes. For certainly the cryptocrystalline forms of silica include as distinctly sphericiform types of accretion as do calcite and arragonite. While in the course of geologic time it is permissible to hypothesize abundant silica resulting from widespread submarine volcanic action or derived from thermal springs or from organic sources, under conditions favoring either siliceous bubble coatings, or direct accretion, dependent on varying alkalinity or acidity, along shore lines or in the ocean depths where occur the most of the organisms containing notable quantities of silica, especially in the early Paleozoic or age of seaweeds.

Bubbles coated by either lime or silica appear to offer the more difficult explanation of oölite origin; but the remarkable regularity with which in the oölitic quartzites radially cryptocrystalline masses of quartz are found to project inwards from the outer rind of concentric layers would be simply explained, if the grains were at any time hollow. In the grains lacking nuclei the central portions have a quartz filling which very well suggests a tiny geode. But on the other hand this cryptocrystalline quartz which continually tends to assume true hexagonal structure is doubtless comparable to that of the spheno- and sphærocrysts observed actually traversing the cell structure of fossil woods, where, though some lime may have been present and played a part in chemical change, the process of petrifaction consisted in the direct deposition of silica, the fair assumption being that the siliceous cast of the original woody structures and the sphærocrysts traversing them were both formed simultaneously or virtually so. And by analogy it seems certain that the sphenocrysts of the oölite grains, if formed during replacement of a calcareous by an opalaceous groundmass, would often be observed to traverse concentric lineations.

Nor is it yet proven that lime and silica could not be alternately deposited on a single spherulite by chemical reactions strictly "reversible" for these substances. One needs but to recall that both animals and plants even within the same group use both lime and silica in building up their skeletal structures, a strong proof of the delicate balance between lime and silica deposition. Indeed there is good evidence distinctly pointing to the possi-

bility of alternant deposition of lime and silica, or silica and hematite whether or not the grains are formed by direct accretion. At any rate I have found in the siliceous oölite boulders pockets filled with loose quartz crystals and fine grains of oölite either solid or the thinnest of shells, which latter possibly are the zone of the grain first segregated and most resistant to solvent action. And similarly when the oölitic hematite of the Clinton formation is subjected to acid action as was observed by Smyth (10) thin siliceous tests, scarcely noticeable in the thin sections are left behind. That these were directly deposited on the grains (as they increased in size) was the original view which I fully accept, as do also Newland and Hartnagel (26) in their study of the Clinton ores, it being very clear that the burden of proof rests on any other explanation. While just as the consensus of opinion now is that the advocates of the pseudomorphic origin of the Clinton iron ore deposits have utterly failed to sustain their views so the universal siliceous replacement theory of oölite origin is too restricted to fit all the known facts.

Another fact bearing on this question is the uncrushed condition of the great silicified seaweed rims accompanying the oölites. That these fossils are not secondary replacements of calcite after some great interval of time is the strong presumption already noted; and that what is true of their origin is also true of that of the oölites is a probability worthy of record.

Finally the rarity of siliceous oölites in later geologic facies has little bearing on the question of siliceous *versus* calcareous deposition. The absence of lime oölites in many formations is as good a kind of scientific *tu quoque* argument. Besides, it may yet be found that there have been some very fundamental changes in lime and silica distribution in the course of geologic time, if not exactly in the period marked by the siliceous oölites. Indeed it is a facile supposition that the Ozarkian may be included in the older time of thinner and even warmer crusts favoring thermal solution of silica along shore lines or over wide areas of the sea bottoms; and it is a very fundamental if not a related fact that not until the Ozarkian did animal secretion of lime become a marked geologic factor.[1]

It will have been noted that in these studies of Paleozoic seaweeds and oölites one does not find additional support for the view of Wethered gained

[1] "During the Ozarkic period, for the first time in the history of the earth, the animals living in the sea, especially the mollusks, began a general secretion of calcareous skeletons. Of course the sponge-like corals of the Georgic had the lime habit much earlier, but until the Ozarkic in none of the earliest faunas did the secretion of lime become a factor among many types of invertebrate animals. That this mode of protection was of great benefit to the creatures possessing it is seen not only in the rapid rise of genera and species in the Ozarkic, but also in the marked increase in the size of individuals. This evolution is particularly noticeable in the middle and upper beds of this period."

Schuchert,— Paleogeography of North America, p. 524.

from his interesting and valuable studies mainly based on the oölites of mid-geologic time but also including ancient calcareous oölites, that all the oölites are accretions of filiform algæ (Ref. 12 and other papers in Quart. Journ. Geol. Soc.). On the contrary it seems that the grains of siliceous oölites are quite free from traces of algæ, and apparently due to direct deposition, though the chemical changes involved in their formation may well have depended on algal growth or decay. Also there is the strong presumption that both lime and silica often entered into the initial building up of the grains, with but little subsequent replacement. Moreover, in connection with the oölite problem it will unquestionably be found instructive to more carefully consider the sphæro- and sphenocrysts already briefly commented on. I have figured remarkable examples of the latter in my American Fossil Cycads (Plate XXVIII, Fig. 1, and Plate XXIII, Fig. 6), while Seward shows a most pronounced instance of sphærocrystic structure traversing the tissues of a silicified *Lepidodendron* stem in his Fossil Plants, Vol. I, figs. 14 and 15 (20). In addition I may mention that both these structures of pronounced type and striking form are present on a large scale in the silicified stems of conifers which occur so abundantly in the strata of the Black Hills rim yielding the fossil cycads. These structures apparently traverse the trunks of the largest forest trees of the "Rim," and in some weathered specimens the appearance would even suggest an oölite to the unpracticed eye. (*Cf.* lower Fig., Plate XVIII, showing oölitic sphenocrysts.

Evidently such structures appear capable of several explanations. It might be suggested that the spherulitic structure resulted from calcification as the very first step in the mineralization of these trunks, and that secondarily silicification of tissues set in with replacement finally of the calcite in the spherulites. But on the other hand the sphenocrysts have the characteristic hexagonal forms of quartz, and moreover, they seem to graduate by almost insensible degrees into forms with concentric banding. Also it is interesting to observe that in some of the stems there is a decidedly lenticular form of the sphærocrysts which may be due to pressure in the opaline state before the final stages of induration.

From all the evidence at hand, we may conclude that in the presence of abundant silica in the colloidal to partially soluble state there is a strong tendency of the molecules to aggregate concentrically, and that consequently the direct formation of oölitic quartzite is a possibility. But that all of the conditions requisite for the formation of siliceous oölite were mainly confined to the early Paleozoic is likewise apparent. Similarly one cannot fail to note that actual observations of oölites in process of formation have been thus far exceedingly limited and restricted to relatively shallow lime laden waters. Very different must be the processes which go on in the ocean depths where mainly occur the forms which segregate organic silica.

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EXPLANATION OF PLATES.

Plate XIV.

Fig. 1. *Cryptozoön bassleri.* × $\frac{1}{4}$. In vertical transverse section (same specimen as figure in text) showing that scorpioid dichotomy of the laminar aggregates results from procumbency.

Fig. 2. *Cryptozoön bassleri.* × $\frac{1}{4}$. Superior view of a segment from the left terminus of one of these huge crescentiform thalli. Observe to the left the heavily rounded end, which is but little broken near the inner margin, and is in nearly radial position. In Plate XVIII occur the only suggestions of proximal portions of thalli. The straight right border is the edge of the polished section shown in Plate XV. The ordinary process of photographic reproduction yields in this and succeeding figures very nearly the natural colors of the original specimens.

Plate XV.

Cryptozoön bassleri. × $\frac{3}{8}$. Same segment as in preceding Fig. 3, showing to better advantage the furrowing of the upper surface, and also the polished radial vertical section. Note unequal scorpioid dichotomy of the laminæ which appear in more or less regular series corresponding to furrowing of the superior surface.— The absolute freedom from either crushing or fracture of this and other of these specimens, except solely the specimen of Plates XVI and XVII is a striking feature indicating early silicification of these gigantic fossils.

Plate XVI.

Cryptozoön bassleri. × $\frac{1}{5}$, nearly. Segment from mid region of largest form recovered, showing to advantage the uneroded superior surface with sharp furrows and small crenulations.— Observe with a reading glass how small but regular is the crenulation of the laminæ in these specimens. They vary markedly from *Cryptozoön proliferum* and all other types in this respect.

Plate XVII.

Cryptozoön bassleri. × $\frac{1}{3}$, nearly. Same specimen as preceding in polished radial vertical section. External border somewhat broken away. This specimen shows a vertical cleavage which is entirely secondary and was developed during erosion long after the opalaceous condition of initial silicification had been passed. The presence and character of a slight secondary faulting on the cleavage lines shows this. Even from this figure these facts and features will be apparent after a little attentive study with a reading glass. Weight 140 kgs.

Plate XVIII.

Fig. 1. *Cryptozoön bassleri.* × $\frac{1}{3}$. Polished radial section showing inferior, and perhaps also superiorly, appressed individuals. The appearance seen here is not fully understood, since no other specimens so far recovered suggest such a com-

plexity of the individual plant as existed if these branches all belonged to one individual. If they did so belong it follows that after growth of the two main normally shaped thalli had progressed to the point of ventral appression the two triangular spaces left over above and below were then closely occupied by a third or perhaps a third and a fourth thallial branch or outgrowth with some intergrowth due to appression. This section would then pass very near to the insertion of the free thalli on the central mass or holdfast. So that the suggestion of an asteriate form made in the text has in its favor two observed features; 1stly the condition seen here, and 2ndly the turbinate forms of the young or simpler types of Saratogan Cryptozoons. Such features would at the same time afford the broadest of specific differences from any of the Cryptozoons so far reported.

a, *b*, *c*, *d*, are the four separate thallial axes, and *f* a line of fracture corresponding in position to f^1 along which latter node the appearance suggests continuous growth or else complete fusion.

Fig. 2. Two grains of oölitic quartzite from near the Pennsylvania State College, Centre Co., Pennsylvania (locality A in map, reference 31). Enlarged 60 times and photographed in reflected light passed through a blue screen to bring out details of the *sphenocryst zone.*

Following the primary deposition of a clear opaline *nucleus* with or without a *nucleolus* and envelopment by the finely concentric indurated outer *test*, the radially arranged sphenocrysts were formed during final dehydration. Initial radial structure of the quartz may also occur. The process may be considered as directly chemical, the silica being inorganic, or organic and segregated just as is the silica of the siliceous nodules of the deep ocean floor.

[Hand specimens I collected over twenty-five years ago show how reversible chemical reactions account for deposition of these grains. Either the initial or terminal step consisted in the formation of characteristic siliceous chert which passed directly into the oölitic quartzite with simultaneous formation of rhombic calcite as proven by the presence of rhombohedral cavities which are sometimes *penetrated* by the oölitic spheres or again *shear* these like a knife edge. At times very small and perfectly formed rhombohedral cavities *cut* into the tests of individual grains. When siliceous deposition was completed crystalline calcite still remained imbedded just as in the Crystal Mountain silicified wood mentioned in the footnote, p. 241, the selenite crystals so occur. But while the calcite in the oölite was finally dissolved out, the selenite in the silicified wood, once protected from the action of water, proved very permanent.

Deposition of (1) chert, (2) arragonitic oölite, (3) rhombic calcite, (4) arragonitic oölite with calcite, (5) siliceous replacement of oölite $CaCO_3$, and (6) solution of the crystalline calcite would be only one of the various other alternative and in reality difficult explanations of these specimens.]

Plate XIX.

Fig. 1. *Cryptozoön proliferum* (Hall) forming a reef outcrop in the Saratogan limestone (Conococheague) in the battlefield of Antietam, Maryland. The details appear in about one-sixth the natural size, and one readily notes the heavy striate mass above with the lesser crescentic to sub-circular outlines in considerable abundance below. From a photograph by R. S. Bassler.

Fig. 2. *Cryptozoön proliferum* (Hall). Reef on Antietam battlefield. Portion of preceding figure somewhat enlarged with continuation to right,— both figures thus representing a length on the reef of a meter or more. The upper seemingly denser portion of the reef shows the characteristic cleavage running nearly vertical to and obscuring the lineations formed by the emergence of laminæ.

1

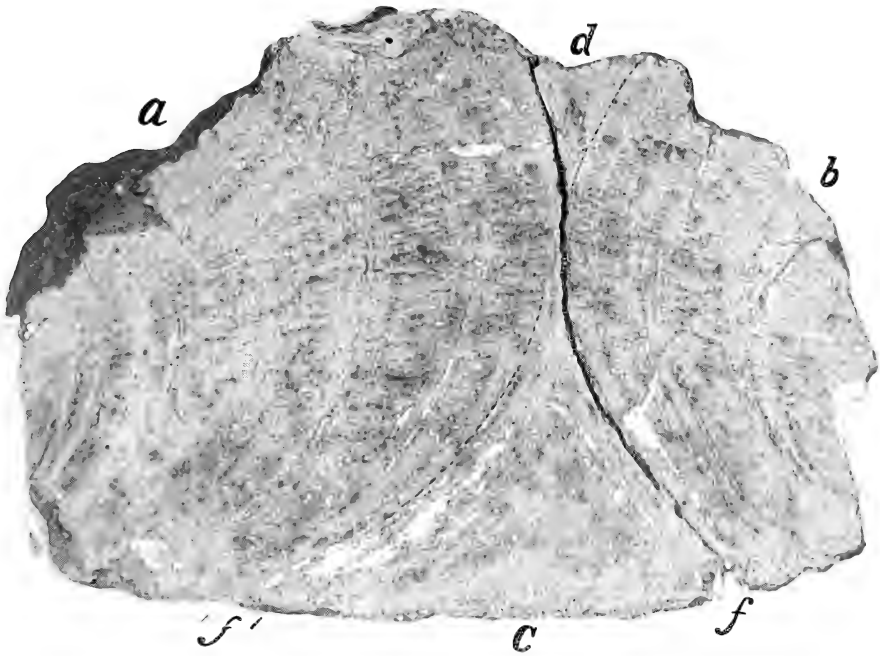
2

CRYPTOZOÖN BASSLERI. × $\frac{1}{4}$.

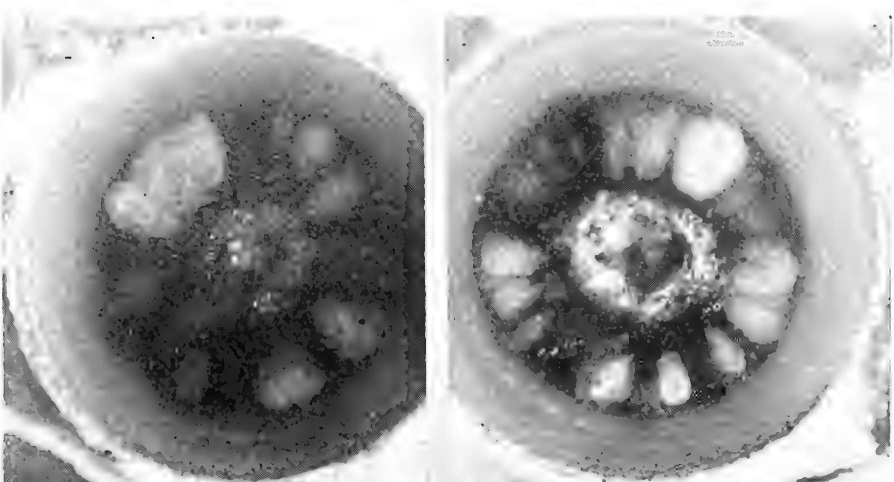
CRYPTOZOÖN BASSLERI. × $\frac{3}{8}$.

Cryptozoön bassleri. × 1/5, nearly.

Cryptozoön bassleri. $\times \frac{1}{3}$, nearly.



1



2

Fig. 1, CRYPTOZOÖN BASSLERI. × $\frac{3}{4}$. 1/3
Fig. 2, SPHENOCRYSTIC OÖLITE. × 60.

1

2

CRYPTOZOÖN PROLIFERUM (*Hall*), in situ.

59.7(81:22)

Article XX.— FISHES FROM SOUTH TRINIDAD ISLET.

By John Treadwell Nichols and Robert Cushman Murphy.

On April 8, 1913, during the course of the expedition to the island of South Georgia, conducted by the American Museum of Natural History and the Brooklyn Museum, Mr. Murphy made a small collection of fishes at Trinidad Islet in the South Atlantic (latitude 20° 30′ S., longitude 29° 22′ W.). This collection is now in the American Museum of Natural History, where it has been critically studied by Mr. Nichols. Nine species are represented, all characteristic of the tropical Atlantic fauna, though, not counting an embryonic shark which may belong to an undescribed species, one specimen should be described as a new species and another is at least a new race.

Knight, in the 'Cruise of the Falcon' (London, 1887) and the 'Cruise of the Alerte' (London, 1907), refers to the abundance of fish at Trinidad, but in only one instance can the vernacular names which he uses be fixed with any degree of certainty upon a definite species, viz., *Coryphæna hippurus*. In the 'Falcon,' p. 302, he writes: "I was aware that the sea round any desert isle....always teemed with fish, but I had no idea that any portion of ocean ever swarmed with life to such a marvellous extent as is the case round this islet" [Trinidad]. Again, p. 303: "There were eight distinct varieties of fish, [exclusive of sharks]....crowding the waters around our hull."

We know of only one technical list of Trinidad fishes previously published,— that of George Murray in the Geographical Journal, 1902, page 434. This list, with five Atlantic fishes, named also three Indian species — *Muræna punctatofasciata* Bleeker, *Epinephelus merra* Bl., and *Glyphidodon* [*Abudefduf*] *bengalensis* Bl. The great distance separating India from Trinidad, and more especially the cold northward flowing current of the eastern South Atlantic, make it very unlikely that fishes would be common to both places without also occurring in the West Indies, and we have little hesitation in referring the two species last recorded to closely allied Atlantic forms, *Epinephelus adscensionis* (Osbeck) and *Abudefduf saxatilis* (Linné). The first of the three named is perhaps referable to the Atlantic *Echidna catenata* (Bloch), with which Bleeker at first confused the East Indian fish which he later described as *Muræna punctatofasciata*. In the following list are included the species mentioned by Murray as well as those in the present collection.

Ginglymostoma cirratum (*Gmelin*).

These sharks were found common, and the head of one collected. Their mouths contained leeches of the genus *Piscicola*. Among the Portuguese sailors they were called "Gata," and their liver oil had high medicinal repute. The otoliths of this and other sharks are used by Portuguese islanders and West Indians as a diuretic.

Carcharhinus sp.

The collection contains an embryo shark of this genus, very likely belonging to an undescribed species. Its pectorals are very long and bluntly rounded, and its fins boldly black tipped.

It is 670 mm. in total length and 480 mm. to the base of the caudal fin. Snout moderately rounded. First dorsal high, the distance from its origin to apex contained 5.5 times in the total length of the fish, including caudal; inserted a short distance back of the axil of the pectoral. Second dorsal and anal small, moderately produced behind, of about the same length, the anal slightly higher, with a broadly rounded apex. Pectoral narrow and very long, not reaching base of ventral by a distance about equal to the diameter of the eye, its greatest breadth contained about 2.4 in its length, its apex very broadly rounded. Mouth wide, its distance from tip of snout contained 1.5 in the distance between the corners of the mouth. Teeth of both jaws narrow, on broader bases. Those of the upper jaw slightly oblique, coarsely and bluntly serrate except at apex. Those of lower jaw slightly narrower, more erect, and scarcely — if at all — serrate. Color gray, ventral surface and lower side of pectorals whitish. Caudal pale, thickly freckled with gray. Upper edge of the caudal, narrow apical edge of the first dorsal, terminal blotches on lower caudal lobe, second dorsal, anal, ventral, and pectoral respectively, also a blotch on the peduncle at the base of the upper caudal lobe, black.

The mother was about 2 meters long.

? **Echidna catenata** (*Bloch*).

Muræna punctatofasciata Murray, Geographical Journal, 1902, p. 434.

Hemirhamphus brasiliensis (*Linné*).

Four specimens, 345 to 385 mm. in total length. All about the surface of the water near shore were schools of these silvery fish. The Portuguese sailors threw scraps of fat into the water and caught many of them in their hands.

Holocentrus ascensionis (*Osbeck*).

One specimen.

Caranx lugubris *Poey.*

The single specimen obtained, 445 mm. long to notch of caudal fin, has short pectorals (about equal to head) and scaly soft dorsal and anal fins, and may be separable from, though close to, *lugubris,* of which we consider *ascensionis* (Bloch & Schneider), and Cuvier & Valenciennes, a synonym.

Coryphæna hippurus *Linné.*

The dolphin mentioned by Knight, 'Cruise of the Alerte,' p. 139, is doubtless of this species. One was taken by Mr. Murphy on April 7, within a few hours sail of Trinidad.

Epinephelus adscensionis (*Osbeck*).

Epinephelus merra Murray, *l. c.*

We have one specimen 300 mm. in total length. The very large sea-

Fig. 1. A sea-bass or "Garupa" bitten in half by a shark; Trinidad Islet.

bass, of which a photograph is here published, was bitten in two by a shark while being landed. It was probably not of this species.

Anisotremus sarugo sp. nov.

The type and only specimen, No. 5070 American Museum of Natural History, 400 mm. long to base of caudal, has the head 2.9 in that length, depth 2.3. Eye 5 in head. Snout 2.5. Dorsal XII, 18. Anal III, 10. Scales about 50, those above lateral line in oblique series, not at all parallel with it; those between the anterior portion of the spinous dorsal and the base of the pectoral somewhat enlarged. 6 in

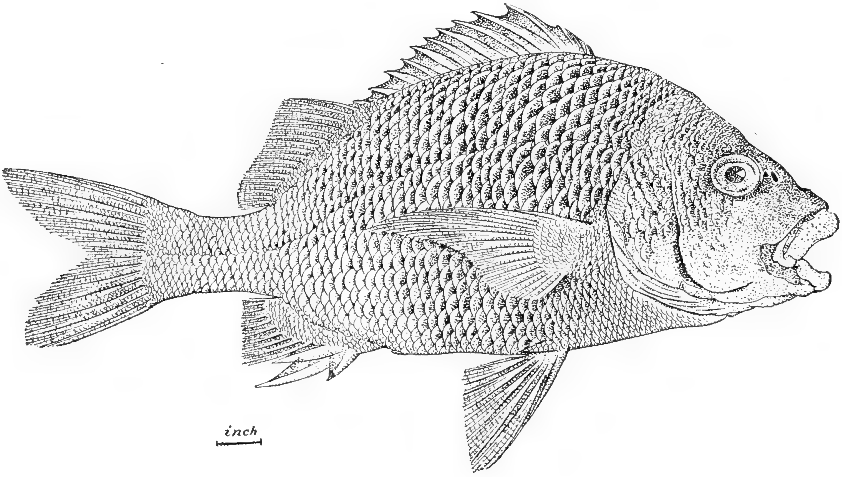


Fig. 2. *Anisotremus sarugo* sp. nov.

a vertical and 9 in an oblique series between the origin of the dorsal fin and the lateral line. Second anal spine contained 2.4 in head, fourth dorsal spine 2.4. Pectoral slightly shorter than head. Body elevated, the profile not very steep. Eye 1.5 in interorbital. Lips very thick. Maxillary not quite reaching vertical from front of eye, contained 2.8 times in head. Snout 2.4. Preopercle weakly serrate. Teeth in jaws minute in bands, a larger outer series. Gray, with dark bases to the scales.

Allied to *Anisotremus surinamensis,* from which it differs in the greater vertical fin-count, shorter anal spine, and differently shaped head. "Sarugo" was the name by which this species was known to the Portuguese sailors.

Abudefduf saxatilis (*Linné*).

Glyphidodon bengalensis Murray, *l. c.*

Iridio radiatus (*Linné*).

Platyglossus cyanostigma (Cuv. & Val.); Murray, *l. c.*

Teuthis hepatus *Linné.*

Acanthurus chirurgus (Bloch); Murray, *l. c.*

Balistes vetula trinitatis subsp. nov.

The type and only specimen in our collection, No. 5071, American Museum of Natural History, is 385 mm. long to base of caudal. Head contained 2.7 times in this measure, depth 1.9. Thickness of body contained 2 times in the head, eye 5.0. Head pointed, dorsal and ventral outlines similar. From the origin of the spinous dorsal to the tip of the snout is a straight, slanting line. The corresponding ventral contour is almost equally straight. Soft dorsal falcate, ending in a double filament. The filamentous portion about equals the non-filamentous height of the fin, each contained about 1.3 in the head. The anal is high, bluntly pointed, its longest ray 1.4. The corners of the caudal are produced in filaments, that of the upper the longer.

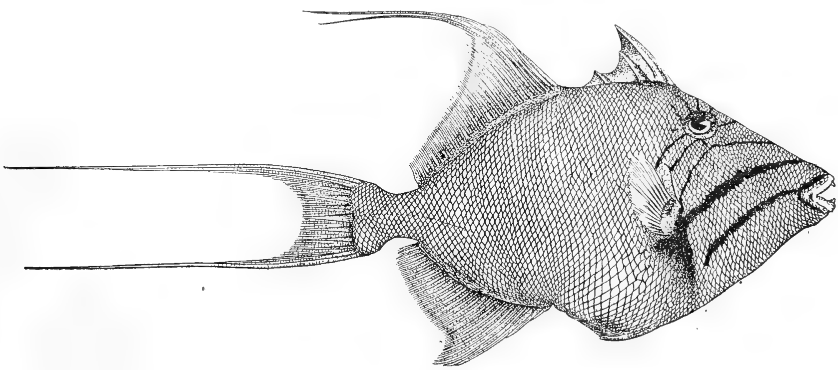


Fig. 3. *Balistes vetula trinitatis* subsp. nov.

Dorsal III — 29. Anal 27. Scales about 62. A line drawn from the origin of the soft dorsal to the origin of the anal would cut the lengthwise axis of the body a distance before the base of the caudal contained 2.5 times in the length to base of caudal. The depth of the head at the posterior angle of the maxillary fold is contained 2.3 in the head. The color is much as in *B. vetula*, but not exactly the same. A black (bright blue in the fresh specimen) stripe crossing snout sends a loop around chin and extends backward along side of throat to under eye. A second stripe, narrow where it crosses snout, broadens on the side of head, extends to base of pectoral fin, which it touches, and thence forming an obtuse angle, extends to a lower point than that reached by the first stripe.

Close to *Balistes vetula* as occurring in the West Indian fauna, but more pointed anteriorly than any specimen of that species seen by us. The second stripe on the head, instead of forming a regular curve which does not touch the base of the pectoral fin, as in *vetula*, touches the base of this fin at the

apex of an obtuse angle; it is also rather broader and less regular posteriorly. In our judgment this form is only worthy of sub-specific rank. If it proves to be the same as the fish inhabiting Ascension Island, which is not impossible, it should stand as typical *vetula,* and a new name should be found for the West Indian fish.

Canthidermis maculatus (*Bloch*).

Balistes maculatus BLOCH; MURRAY, *l. c.*

Melichthys piceus (*Poey*).

Balistes buniva GÜNTHER; MURRAY, *l. c.*

Our collection contains a single specimen of this fish 325 mm. in total length. It was dark green, with a pale blue line at the bases of soft dorsal and anal fins.

Labrisomus nuchipinnis (*Quoy & Gaimard*).

Clinus nuchipinnis QUOY & GAIMARD; MURRAY, *l. c.*

Aside from the species not previously described, all those here recorded occur in the West Indies. In general they are forms widely distributed in the warmer Atlantic waters, and sometimes beyond (*Caranx lugubris, Coryphæna hippurus, Abudefduf saxatilis, Balistes vetula, Canthidermis maculatus*), with a tendency to turn up at isolated islands. Ten or eleven of the sixteen species listed are known from Bermuda, namely, *Ginglymostoma cirratum, Echidna catenata, Hemirhamphus brasiliensis, Holocentrus ascensionis, Coryphæna hippurus, Epinephelus adscensionis, Balistes vetula, Abudefduf saxatilis, Iridio radiatus, Teuthis hepatus, Canthidermis maculatus;* at least four from Ascension Island, *Holocentrus ascensionis, Caranx lugubris, Epinephelus adscensionis, Balistes vetula. Hemirhamphus brasiliensis* and *Labrisomus nuchipinnis* are recorded from the Canary Islands, *Ginglymostoma cirratum* from the Cape Verdes, *Melichthys piceus* from St. Helena.

In view of differences in comparatively contiguous shore faunæ, the conformity of the Atlantic insular ichthyofauna is rather surprising, and might repay careful study.

56,973(1181:7)

Article XXI.— A REVISION OF THE BUNODONT ARTIODACTYLA OF THE MIDDLE AND LOWER EOCENE OF NORTH AMERICA.

By William J. Sinclair, Princeton University.

Introduction.

The collections of the American Museum of Natural History from the Bighorn and New Mexican Wasatch, the Wind River and the Bridger contain a number of new genera and species of bunodont artiodactyls which it is the purpose of the present article to describe. The writer's acknowledgements are due to Professor Henry F. Osborn for the opportunity to study the collections here reported on, to Dr. W. D. Matthew and Mr. Walter Granger for many helpful suggestions, and to Professors Charles Schuchert and R. S. Lull for permission to examine the Marsh types in the Peabody Museum of Yale University.

With the exception of *Trigonolestes* (= *Diacodexis* Cope) our knowledge of Lower Eocene artiodactyls has hitherto been limited to a few specimens described by Professor Marsh under the names *Eohyus distans, Eohyus robustus, Parahyus vagus* and *Parahyus aberrans.*[1] Of these, *Eohyus distans* is based on a single third upper molar wholly unlike that of any of the artiodactyls in the American Museum collection and may be regarded for the present as of uncertain systematic position. *Eohyus robustus* is, unquestionably, referable to *Periptychus,* and both species of *Parahyus* far exceed in size any of the forms here discussed and are probably Achænodonts. The American Museum collections have added three new genera and seven new species to the list besides increasing our knowledge of the skull and skeletal characters in some of the forms already known.

If more or less uncertainty still exists regarding the systematic position and relationships of the new forms here described, it is because of the fragmentary character of the material, mainly parts of jaws unassociated with remains of the skeleton. In but few instances has the typical artio-

[1] The types of both *Eohyus distans* and *E. robustus* are said to be from the Lower Eocene (Wasatch) of New Mexico. Some doubt seems to exist regarding the horizon of the two species of *Parahyus.* Marsh states that they are from the Coryphodon beds of Wyoming. Hay's catalogue locates them in the Bridger, while Matthew's checklist (U. S. G. S. Bulletin 361) gives the locality as Coryphodon zone, Black Buttes, Washakie Basin, Wyoming. Professor R. S. Lull kindly informs me that the type of *P. vagus,* catalogue No. 10972 Yale University Museum, comes from Bitter Creek Station, Wyoming. *P. aberrans,* catalogue No. 10027, was shipped from Fort Bridger, Wyoming, and this is the only record regarding its geographic locality.

dactyl astragalus been found in undoubted association with the tooth-bearing parts of the skull. The reference of these Lower and Middle Eocene bunodonts to the Artiodactyla must, therefore, largely depend on such dental characters as can be worked out from specimens in which the teeth are positively associated with foot-bones of artiodactyl type.

Family DICHOBUNIDÆ.

Wasatchia new genus.

Dentition $\frac{?}{?}, \frac{?}{?}, \frac{4}{4}, \frac{3}{3}$. P^3 trenchant, with small deuterocone and slight posterior cuspule. Anterior cuspule, if present, broken off; p^4 with large deuterocone and broad antero-external cuspule. M^1 and m^2 quadritubercular with small hypocone; m^3 tritubercular with incipient hypocone. Small intermediates apparently present. Cusps bunoid. Cingula on molars continuous except for slight interruption internally on m^1 and m^2.

Lower premolars, except the first, double-rooted, separated by short diastemata; p_2 simple, trenchant, without accessory cuspules; p_3 with laterally compressed crown,

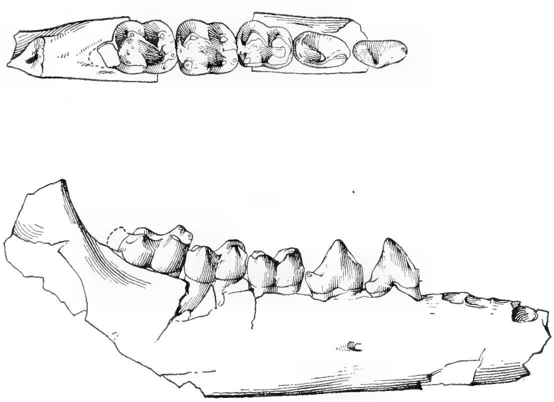


Fig. 1. *Wasatchia grangeri*, lower jaw, superior view of left ramus with p_3 reversed from opposite side, and external view of right ramus with p_4 and m_3 reversed from opposite side, nat. size. Type specimen No. 15516.

small anterior cuspule and narrow, cingulum-like posterior ledge; p_4 less compressed, with anterior cuspule a little stronger than in p_3 and a broader heel-ledge. No deuteroconid.

Paraconid smaller than metaconid but always present on lower molars. Heels of anterior molars wider transversely than trigonids; in m_3, heel a little narrower transversely than trigonid. Hypoconid of m_3 as large as, or larger, than protoconid; hypoconulid and entoconid subequal.

Mandible not strongly convex inferiorly, not increasing rapidly in depth below m_2.

Wasatchia grangeri n. sp.

Type. Parts of both rami of the lower jaw (Amer. Mus. Coll. No. 15516). From the Bighorn Wasatch (Gray Bull beds) two miles southwest of St. Joe postoffice (horizon 3 of Sinclair and Granger, Bull. Am. Mus., Vol. XXX, p. 108 and Fig. 2B), Bighorn County, Wyoming. Amer. Mus. Expd. 1910. The species is named in honor of Mr. Walter Granger.

Measurements.

	mm.
p_2–m_3	50
m_1–m_3	25.5
p_3, long diam.	7
p_4 " "	7
m_1 " "	7
m_2 " "	7.5
m_3 " " approx.	11
p_3, trans. diam.	3
p_4 " "	4
m_1 " " across heel	5.5
m_2 " " " "	7
m_3 " " " "	6.5
m_3 " " " trigonid	6.8
Depth of mandible below p_3	12
" " " " m_2	14

Separable from *Wasatchia dorseyana* n. sp., which approaches it in dimensions, by the slightly larger size of the teeth, the larger hypoconid on m_3, the barely visible anterior basal cuspule on p_3, the limitation of a cingulum to the anterior face of m_1, and by the slightly greater degree of rugosity of the enamel on the outer surface of the tooth crowns, but this may be a feature due to their almost unworn condition.

Wasatchia dorseyana n. sp.

Type. Palate and fragment of right mandibular ramus with m_3 (Amer. Mus. Coll. No. 15673). From the Bighorn Wasatch (Gray Bull beds) at the head of Dorsey

Fig. 2. *Wasatchia dorseyana*, upper jaw and last lower molar (right), nat. size. Type specimen No. 15673.

Creek (horizon 3 of Sinclair and Granger, Bull. Am., Vol. XXX, p. 108 and Fig. 2B), Bighorn County, Wyoming. Amer. Mus. Exp. 1911.

Two other specimens in the collection seem referable to this species:—

No. 15517, including a lower jaw, the distal end of a tibia and an astragalus of the usual artiodactyl pattern from the same horizon as the type of the species, but a different locality, 2 miles south of St. Joe postoffice, Bighorn County, Wyoming.

No. 16295, the right ramus of a lower jaw with p_2–p_4, part of m_2, and m_3 from the upper levels of the so-called New Mexican Wasatch (Largo beds = Lost Cabin, Wind River), about 10 miles west of Laguna Colorado, Rio Arriba County, New Mexico. American Museum Expedition, 1912.

Measurements.

	No. 15673 mm.	No. 16295 mm.
p^3–m^3, length	33.3	
p^3 long diam.	6	
p^4 " "	6	
m^1 " "	6.5	
m^2 " "	7	
m^3 " "	7	
p^3 trans. diam.	4	
p^4 " "	7.3	
m^1 " "	8.3	
m^2 " "	9	
m^3 " " at widest part	8.5	
p_2–m_3, length		43
p_2 long diam.		4.6
p_3 " "		7.2
p_4 " " (approx.)		7
m_3 " "	9	8.5
m_3 trans. diam. of trigonid	6.2	5.3
" " " " heel	5.2	5

Assuming that Nos. 15517 and 16295 are correctly referred here, the characters of this species may be summed up as follows: —

Readily separable from *Wasatchia grangeri* by its smaller size, large anterior cuspule on p^3 and the development of a slight external cingulum on the molars, so far as preserved, though, with respect to this last mentioned character, some variation may occur, as in a specimen from the same horizon in the Bighorn Wasatch as the type, but from a different locality (Amer. Mus. Coll. No. 15,517, Fig. 3), the cingulum is absent.

The upper dentition has already been characterized in defining the genus. Except for their smaller size, the teeth closely resemble those of *Helohyus*, a Bridger bunodont artiodactyl, undoubtedly related to *Wasatchia*. In both, the tooth cusps are bunoid, the third premolar is trenchant with a

slight deuterocone, the fourth has a large, conical deuterocone and prominent anterior basal cuspule, the first two molars are quadritubercular, with a small hypocone rising from the cingulum while the third is tritubercular, with the hypocone faintly indicated. In both, the cingulum is more or less complete, except internally. Intermediate cuspules seem to have been present in *Wasatchia* but their character is obscured by the wear to which the tooth-crowns have been subjected.

The characters of m_3 are the same as in the genotype with the addition of anterior and external cingula. As already noted, these appear to vary. P_{2-4}, preserved in No. 16295 from New Mexico, are laterally compressed blades without accessory basal cuspules in p_2, but with these well developed in p_3. P_4 has the characteristic cingulum-like heel, but the anterior cuspule is broken off.

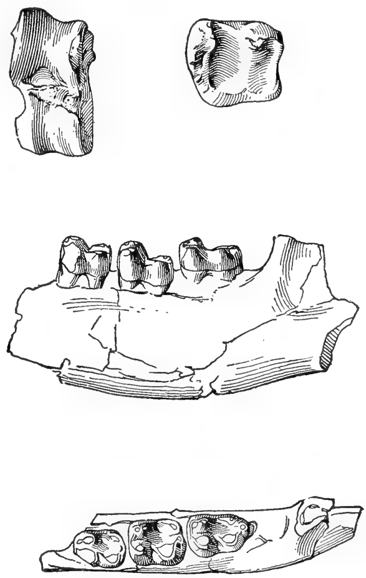


Fig. 3. Artiodactyl referred to *Wasatchia dorseyana*. Astragalus, distal end of tibia, outer and superior views of lower jaw, nat. size. No. 15517. Gray Bull beds, Bighorn Wasatch, Wyoming.

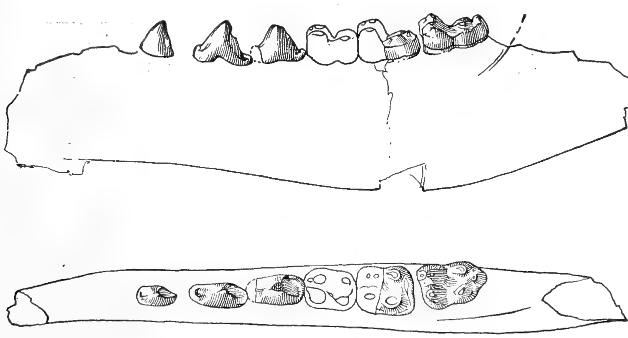


Fig. 4. Artiodactyl inseparable from *Wasatchia dorseyana*. Lower jaws, external and superior views, nat. size. No. 16295. Largo beds (= Lost Cabin, Wind River), New Mexico.

Wasatchia lysitensis n. sp.

Type. Fragments of right and left mandibular rami with m_{1-3} (Amer. Mus. Coll. No. 15660). From the Lysite formation (Wind River group) on Fifteen-mile Creek otherwise known as Dry Cottonwood Creek, Buffalo Basin, Wyoming. Amer. Mus. Exp. 1911.

Paratype. Fragment of the right maxilla with m^1, m^2 and part m^3, lower m_2

and parts of m_1 and m_3 and a small incisor, probably a lower (Amer. Mus. Coll. No. 14936). From the Lysite formation (Wind River group), upper part of the section, Cottonwood Draw, Wind River Basin, Wyoming. Amer. Mus. Exp. 1909.

Measurements.

	Paratype, No. 14936. mm.	Type, No. 15660. mm.
m^1–m^3	23.7	
m^1 ant.-post. diam. externally	7.1	
" " " through center	6.4	
m^2 " " externally	8.7	
" " " through center	7.3	
m^3 " " externally	7.5	
m^1 greatest trans. diam.	9.1	
m^2 " " "	11.1	
m_1 ant.-post. diam.		8.2
m_2 " "	9.1	8.7
m_3 " "		10.4
m_1 trans. diam. through heel	6.3	6.7
" " " " trigonid	—	5.8
m_2 " " " heel	7.5	7.9
" " " " trigonid	6.8	7.2
m_3 " " " heel	5.7	6
m_3 " " " trigonid	—	6.7, 7

Closely approaching *Helohyus plicodon* in size, but undoubtedly referable to *Wasatchia* (of which it is the largest known species) from the character of the heel of the last lower molar which differs from that of *Helohyus* in the

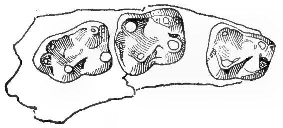


Fig. 5.

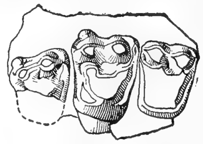


Fig. 6.

Fig. 5. *Wasatchia lysitensis*, m_{1-3} of right side, superior view, nat. size. Second molar reversed from opposite side. Type specimen, No. 15660.

Fig. 6. *Wasatchia lysitensis*, upper molars, nat. size. Paratype, No. 14936.

reduction of the hypoconulid and entoconid and the closer juxtaposition of these cusps. Except in badly worn teeth, a small paraconid is always present. Traces of anterior and external cingula appear on the lower molars. The enamel is almost smooth.

No. 14936 is associated as paratype from the shape of the heel of m_3, which, although somewhat more worn, is indistinguishable from that of the type. The upper molars are suggestively like those of *Helohyus*, differing in having the greatest anteroposterior diameter through the outer cusps while those of *Helohyus* are squarer, their anteroposterior diameters at the center being the same as at the outer margin. M^1 and m^2 are quadrituber-

cular with hypocones as large as in *Helohyus.* M^3 seems to have been tritubercular, but the posterior portion of the crown is broken off. Prominent tubercles rise from the external cingulum at the base of the metacone in m^2 and m^3. A similarly situated tubercle has been observed in m^2 of *Helohyus* and perhaps may be found to occur occasionally on some of the other molars. Cingula probably complete except, perhaps, internally. Small tubercle on anterior cingulum opposite notch between protocone and protoconule absent. The presence of this tubercle is a specific character in *Helohyus plicodon.* It is not found in *H. milleri* and will serve to separate the teeth of *H. plicodon* from those of *Wasatchia lysitensis* which approach them so closely in size. Enamel almost smooth.

The incisor is a small spatulate tooth, probably referable to the lower series.

Bunophorus new genus.

Dentition $\frac{?}{?}, \frac{?}{?}, \frac{?}{4}, \frac{?}{3}$. Upper teeth unknown. Lower premolars, except probably the first, double-rooted, not separated by diastemata; premolars not much compressed laterally, anterior basal tubercles small or absent, heelsc ingulum-like ledges broader in p_4 than in p_3; no deuteroconid on lower premolars.

Molar cusps bunoid; paraconid vestigial or absent; heels of anterior molars as wide as or a little wider than trigonids; in m_3 heel much narrower than trigonid, with hypoconid smaller than protoconid and hypoconulid exceeding in size the entoconid.

Mandible strongly convex inferiorly, rapidly increasing in depth below m_2.

Bunophorus etsagicus (*Cope*).

Type. *Trigonolestes etsagicus* Cope, right and left halves of the mandible (Amer. Mus. Coll. No. 4698). From the Bighorn Wasatch, Bighorn Basin, Wyoming. J. L. Wortman collector, 1881.

Measurements.

	mm.
p_3–m_3	38
m_1–m_3	23.5
p_3, long diam.	7.5
p_4 " "	7.5
m_1 " "	6.5
m_2 " "	7.5
m_3 "	9
p_3 trans. diam.	3.8
p_4 " "	4.8
m_1 " " across heel	5.8
" " " " trigonid	5.3
m_2 " " " heel	6.8
" " " " trigonid	6.8, 7
m_3 " " " heel	5.3
" " " " trigonid	7
Depth of mandible below p_3	10
" " " " m_2	15.3

Cope's original description is, in part, as follows: —

"The heel of the third premolar is obsolete, and that of the fourth is a wide cingulum. Neither exhibit an anterior basal tubercle, and in both the principal cusp is stout. The true molars widen posteriorly to the anterior part of the last molar. The latter contracts rapidly to a narrow heel. The tubercles are all subconic, and the median ones of the last molar are small. There are no cingula and the enamel is smooth.

"The ramus is not robust, and is of moderate depth. Its inferior border rises below the middle of the last molar tooth, and posteriorly. There is a 'mental' foramen below the contact of the fourth premolar and first true molar."

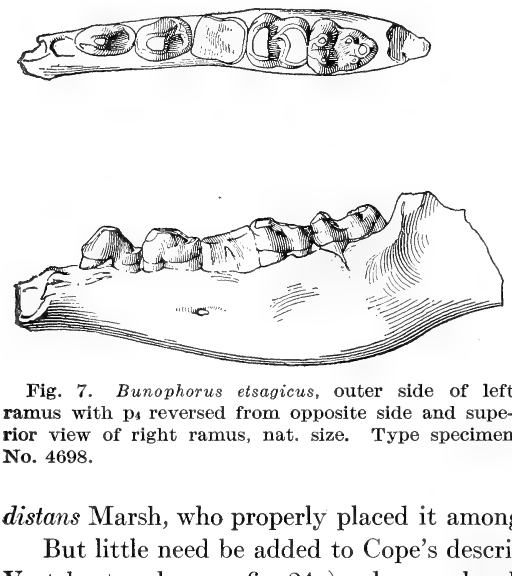


Fig. 7. *Bunophorus etsagicus,* outer side of left ramus with p_4 reversed from opposite side and superior view of right ramus, nat. size. Type specimen No. 4698.

The generic distinctness of *B. etsagicus* was recognized by Wortman in 1898. Referring to *Pantolestes* (i. e. *Trigonolestes*) he writes: "From this genus I exclude the type of *Pantolestes etsagicus* Cope as belonging to a distinct genus ancestral to and leading directly up to the bunodont Artiodactyla. It is very probably synonymous with *Eohyus distans* Marsh, who properly placed it among the Bunodonts."

But little need be added to Cope's description. In his figure (Tertiary Vertebrata, pl. xxv*e*, fig. 24*a*) only one alveolus for p_2 is shown whereas the specimen shows a second alveolus for the anterior root of this tooth. The advanced state of wear of the anterior molars has destroyed all trace of the paraconid if this cusp was ever present in a vestigial condition as seems possible from what has been observed in the other species of *Bunophorus*. Not the slightest trace of paraconid is seen in the almost unworn third molar. Cingula, though feebly developed, are not entirely wanting. A faint anterior cingulum occurs on m_2 and may have been present on m_1. Faint traces of discontinuous external cingula may be seen on all the molars. Enamel practically smooth.

Bunophorus macropternus (*Cope*).

Type. *Phenacodus macropternus* Cope, a fragment of a right mandibular ramus with m_{1-3} (Amer. Mus. Coll. No. 4395). From the Bighorn Valley, Wyoming. It is not certain to what horizon the specimen belongs (i. e. whether Wasatch, Lysite or Lost Cabin). J. L. Wortman collector, 1881.

Measurements.

	mm.
m_1, long diam.	6.1
m_2 " "	6.5
m_3 " "	9.2
m_1 trans. diam. across heel	5.1
" " " " trigonid	4.8
m_2 " " " heel	6.2
" " " " trigonid	6
m_3 " " " heel (approx.)	4.3
" " " " trigonid	6

Original description.— "This species is apparently rare, being represented by only one mandibular ramus, which supports the posterior three molars, and a possible second ramus with molars IV and V. The first and second true molars are much like those of *P. vortmani,* but the third is relatively larger, and has an especially elongate heel. In *P. vortmani* the last molar is constricted, and narrower than the penultimate. In *P. macropternus* there is a weak external and no internal cingulum. The tubercles of the last two molars are quite regularly conical, while the external pair of the first molar wear into crescents. Smaller than *P. vortmani.*"

Fig. 8. *Bunophorus macropternus,* part of right mandibular ramus, superior view, nat. size. Type specimen No. 4395.

Readily separable from *Phenacodus,* to which it has been erroneously referred, by the increase in size posteriorly of the molars (instead of decreasing in size as in *Phenacodus*), by the bunoid outer molar cusps in contrast with their bunocrescentic character in *Phenacodus,* and, finally, in the greater posterior extension of the hypoconulid in m_3 and its greater degree of isolation from the remaining cusps of the heel than in *Phenacodus.*

Owing to the incompleteness of m_3 in the type of *B. macropternus,* comparison with *B. etsagicus* cannot be made as closely as might be desired, but in all respects in which the specimens can be compared there is not sufficient difference to warrant more than a specific separation. The teeth of *B. macropternus* are somewhat smaller than those of *B. etsagicus.* A minute paraconid seems to have been present in m_1 of the type, but this cusp is

entirely wanting in m_2. A vestige of it is found in m_3. In the smaller species of *Wasatchia,* which approach *B. macropternus* in size, the paraconid, though small, is present in all the molars. Cingula are more strongly developed than in *B. etsagicus,* both anteriorly and externally, but are lacking internally. A continuous external cingulum is present about the outer cusps of m_3, while in m_1 and m_2 it is interrupted about the base of the hypoconid. The enamel is slightly rugose.

Cope's second specimen (No. 4394 Am. Mus.), a fragment of the right mandibular ramus with the first and second molars, has the teeth badly worn and lacks the diagnostic third molar. As m_2 shows a well marked trace of the paraconid, a cusp which is absent or at best but slightly indicated in the molars of *Bunophorus,* we may be justified in referring the specimen in question to *Wasatchia.*

Lophiohyus new genus.

Dentition $\frac{3}{2 \text{ or } 3}, \frac{1}{1}, \frac{\text{probably } 4}{4}, \frac{\text{probably } 3}{3}$. Upper dentition almost unknown. Incisors spaced, crowns small, second conical, recurved. Canine large, long, perhaps laterally flattened (only a fragment, split longitudinally, is preserved). Anterior premolars double-rooted, widely spaced and trenchant. Molars known only from a fragment or two, not unlike *Helohyus.*

In the lower series, the tips of the alveoles of two incisors and the alveolus of a small canine are preserved. P_1 single-rooted, p_{2-4} double-rooted. Wide diastemata behind c, p_1 and p_2. No anterior basal cuspule on p_3, posterior cuspules cingulum-like, broader in p_4 than in p_3. Crowns moderately compressed laterally. No deuteroconid.

Lower molars with very small paraconid. Heels of anterior molars wider than trigonids, that of m_3 with large hypoconulid supporting several minor tubercles. External, anterior and posterior cingula present on the molars. Enamel finely rugose.

Mandible decreases slightly in depth anterior to p_3, but otherwise is of about the same depth throughout. Skull with high, thin sagittal crest, rapidly sloping downward and forward to its point of divarication back of the postorbital processes, between which the inclosed frontal tract is smooth.

Lophiohyus alticeps n. sp.

Type. An incomplete crushed skull, lower jaws and fragments of cervical vertebrae (Amer. Mus. Coll. No. 1518). From the Bridger formation, Twin Buttes, Sweetwater County, Wyoming. Amer. Mus. Exp. 1893.

Fig. 9. *Lophiohyus alticeps*, side view of skull and lower jaw, nat. size. Type specimen, No. 1518.

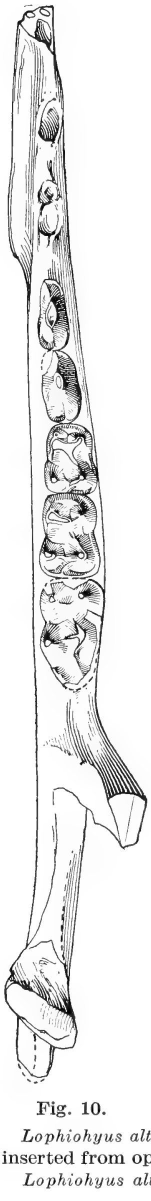


Fig. 10.

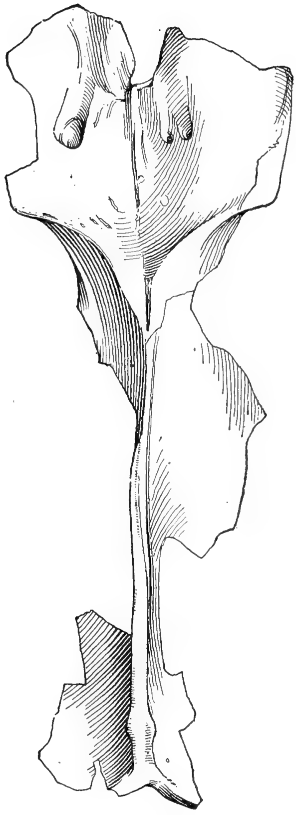


Fig. 11.

Fig. 10. *Lophiohyus alticeps*, superior view of right ramus of lower jaw, nat. size. Incisor alveoli inserted from opposite side. Type specimen, No. 1518.

Fig. 11. *Lophiohyus alticeps*, dorsal view of part of skull, nat. size. Type specimen, No. 1518.

Measurements.

	mm.
Length, lower jaw, incisors to condyles (partly estimated)	133
" lower dentition (p_1–m_3)	73.5
" premolar series including diastemata	41–43
" true molar series	33
" Alveolus of p_1 4.5; Alveolus of p_2 7; p_3 9; p_4	9
" postcanine diastema 6; 2nd diastema 5; 3d diastema	5.5
" m_1 9; m_2 10; m_3 (estimated partly)	14
Depth of jaw at back of symphysis bet. p_2 and p_3	18
" " " " m_2	22
Greatest width of p_3, 3.5; p_4, 4; m_1, 6.5; m_2,	7.5

As but one specimen of a single species is known, the generic and specific characters cannot be separated at present. Apparently, we have in *Lophiohyus* a form closely related to *Helohyus*, but differing, so far as comparison can be made, chiefly in the greater spacing of the anterior lower premolars, the less strongly developed paraconid and the presence of strong external cingula on the lower molars. Probably other differences would appear if both forms were known from more complete material.

The conical, widely-spaced incisors of *Lophiohyus* resemble in a way those of the type of the problematic Bridger genus *Ithygrammodon cameloides* (No. 10125 Princeton University Museum, Fig. 12), which is possibly

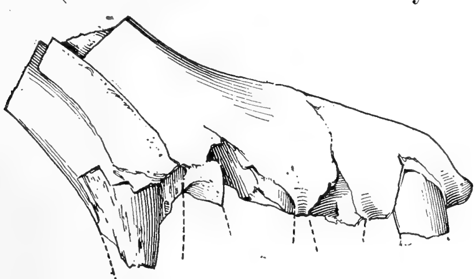


Fig. 12.

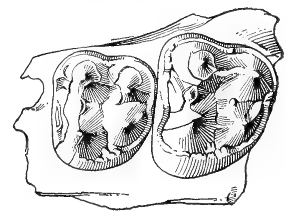


Fig. 13.

Fig. 12. *Ithygrammodon cameloides*, side view of right premaxilla, nat. size. Type specimen, No. 10125, Princeton University Museum.

Fig. 13. Two upper molars of an artiodactyl from the Bridger Eocene, nat. size. No. 10084, Princeton University Museum.

an artiodactyl resembling *Helohyus* or *Lophiohyus*. Two upper molars from the Bridger (No. 10084 Princeton University Museum, Fig. 13) may belong either to *Ithygrammodon* or to Marsh's *Helohyus lentus*, or, possibly, to an undescribed genus.

Helohyus *Marsh.*

Dentition $\frac{?}{?}, \frac{?}{?}, \frac{\text{probably } 4}{4}, \frac{3}{3}$. Upper incisors, canine and anterior premolars unknown; p^3 trenchant, with small deuterocone; p^4 with large, conical deuterocone,

slightly trenchant protocone, small, but distinct, prostyle and strong cingulum, incomplete only about inner side of deuterocone.

Molars 1 and 2 quadritubercular with well-developed intermediates; hypocone a small cusp rising from the cingulum, smaller than the posterior intermediate. Hypocone in m^3 incipient and tooth-crown practically tritubercular. Cingula strong and continuous, except for a slight interruption internally. Enamel finely rugose. Cusps bunoid.

In the lower series, p_1 is probably single-rooted, the remaining premolars double-rooted, trenchant, with cingulum-like heels in p_3 and p_4 and a minute anterior cuspule on p_4. Short diastemata back of p_1 and p_2. No deuteroconid.

Lower molars with paraconid always present. Heels wider than trigonids in m_1 and m_2, a little narrower in m_3. Hypoconulid in m_3 large, often bearing accessory tubercles. Slight anterior and discontinuous external cingula. Enamel finely rugose.

Helohyus milleri n. sp.

Type. Left maxilla with p^3–m^3, and anterior half of left mandible with p_3–m_2. (Amer. Mus. Coll. No. 12151). From the Bridger formation (C5, Lone Tree white layer), Burnt Fork postoffice, Henry's Fork of Green River, Sweetwater County, Wyoming. Amer. Mus. Expd. 1904. The species is named in honor of its collector, Mr. Paul Miller.

Measurements.

	mm.
m^1–m^3	30
p^4 long diam.	7.5
m^1 " "	9.75
m^2 " "	10
m^3 " "	10
p^4 trans. diam.	9
m^1 " " at widest point (approx.)	11
m^2 " " " " "	13.5
m^3 " " " " "	14.5
p_3–m_2	39.5
p_3, long diam.	10
p_4, " "	9.5
m_1 " "	10
m_2 " "	11
p_3, trans. diam.	4
p_4 " "	5
m_1 " " at widest point across heel	7.5
m_2 " " " " " " "	8.5

Somewhat larger than *Helohyus plicodon* from which it differs in the stronger development of an accessory tubercle on the low crescentic ridge

sweeping forward and outward from the anterior margin of the deuterocone in p^4, in the proportionately less strongly developed hypocone in m^1 and m^2, in the greater degree of enlargement of the metaconule in m^3, which gives the posterior margin of this tooth a greater degree of convexity than in *H. plicodon,* and, finally, in the greater projection externally of the antero-external margin of m^2 and m^3 than occurs in the species just mentioned.

Except for larger size, the characters of the lower dentition are as in *H. plicodon.* As m_3 is not preserved, comparison cannot be made with Marsh's *H. validus* and *H. lentus* which are known only from this tooth. Apparently the new species is somewhat larger than *Helohyus validus.*

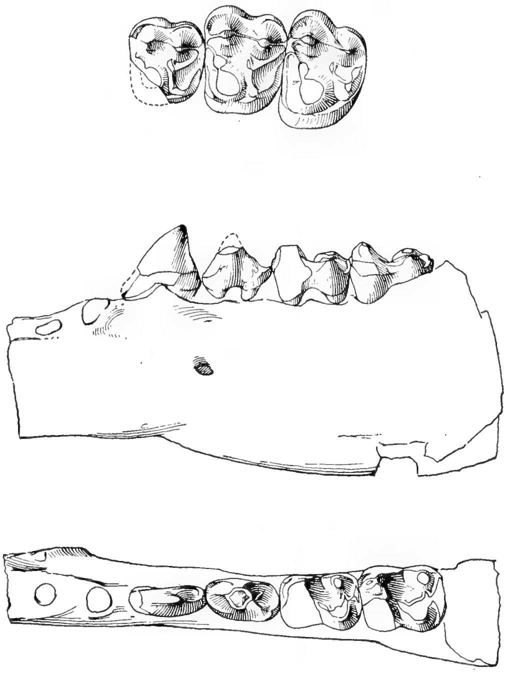


Fig. 14. *Helohyus milleri,* m^{1-3} of left side and outer and superior views of left mandibular ramus, nat. size. Type specimen, No. 12151.

Helohyus plicodon *Marsh.*

Measurements.

	12147 Am. Mus.
	mm.
Length, p^4–m^3	31.5
" p^4	7
" m^1	7.5
" m^2	8.5
" m^3	8.5
Greatest width, p^4	7.5
" " m^1	9
" " m^2	11
" " m^3	11
	12149 Am. Mus.
	mm.
Length, p_2–m_2	43
" p_3	8

	12149 Am. Mus. mm.	12148 Am. Mus. mm.
Length, p^4	8.5	
" m_1	8.75	
" m_2	9.5	9
" m_3		11.5
Greatest width, p_3	3.5	
" " p_4	4	
" " m_1	6	6
" " m_2	7	7.5
" " m_3		7

The additional material of this species of *Helohyus* now available has made it possible to separate generic and specific characters to better advantage. The generic characters have already been listed and need not

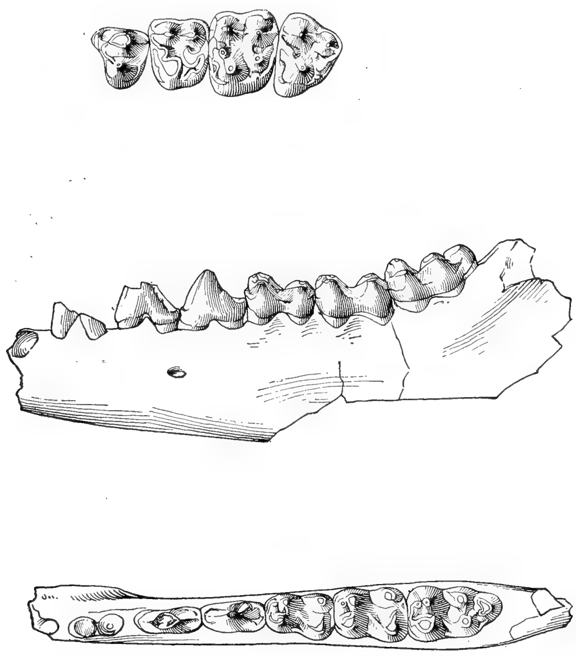


Fig. 15. *Helohyus plicodon*, upper p^4–m^3, nat. size, No. 12147. Side and superior views of left half of lower jaw, nat. size. No. 12149. Last molar and a small fragment of the jaw supplied from No. 12148.

be repeated. *Helohyus plicodon* is distinguishable from *H. milleri* by its smaller size, proportionately stronger development of the hypocone in m^1 and m^2, the straighter posterior border of m^3 owing to the smaller posterior intermediate, and by the approximately equal projection of the external

cusps in m^2 and m^3 while in *H. milleri* the antero-external projects farther outward than the postero-external. From *H. validus* it may readily be separated by the very much smaller hypoconulid on m_3 (see Fig. 16). *H. lentus* (Fig. 17) if correctly referred to the genus *Helohyus,* is a very much larger form. A small tubercle occurring on the anterior cingulum of the upper molars opposite the notch between the protocone and protoconule is present in *Helohyus plicodon,* but absent in *H. milleri.*

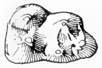


Fig. 16.

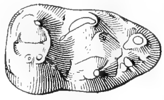


Fig. 17.

Fig. 16. *Helohyus validus,* last, right, lower molar, nat. size. No. 12694.

Fig. 17. *Helohyus lentus,* last, right, lower molar, nat. size. No. 12150.

Helohyus validus and Helohyus lentus.

Each of these species is represented in the American Museum collections by a single tooth. That referred to *Helohyus lentus* (No. 12150, Amer. Mus. Coll., Fig. 17) is from the Bridger formation (D3), Henry's Fork Hill, Sweetwater County, Wyoming. A fragment of the right mandibular ramus with the last molar in place (Amer. Mus. Coll. No. 12694, Fig. 16) from the Bridger formation (B3), on the middle portion of Cottonwood Creek, Bridger Basin, Sweetwater County, Wyoming, apparently pertains to *H. validus.*

The Skull of Helohyus (?).

The posterior half of a skull (Amer. Mus. Coll., No. 13079) associated with an upper p^3 from the Bridger formation (B5, mouth of Summers' Dry Creek, Sweetwater County, Wyoming, Amer. Mus. Exp., 1906) is probably referable, from its size, either to *Helohyus* or *Lophiohyus.*

Fig. 18. *Helohyus* (?), basicranial surface of skull, nat. size. No. 13079.

In the basicranial region (Fig. 18) many striking resemblances are found to the structure of the same tract in *Dichobune leporina,* as figured by Stehlin. The most noticeable of these resemblances appears in the absence of an ossified bulla and auditory meatus. What seems to be the bulla is really the petrous as shown by an orifice (the fenestra rotunda) on its lower surface, posteriorly. As Stehlin observes, this structure may have been, originally, common to all the Artiodactyla. It is perhaps, therefore, not to be regarded as peculiarly dichobunid though certainly retained in this family. As will be seen, later, it occurs also in *Homacodon.* The large postglenoid foramen, the long, broad paramastoid processes and the overlapping of the mastoid process by a lamella of the squamosal are found in *Dichobune, Helohyus* (?) and *Homacodon.* The remaining features of the basicranial region can be ascertained to better advantage from the drawing (Fig. 18) and need not be described in detail. On the dorsal surface of the skull fragment, the temporal ridges resemble those of *Lophiohyus.* The sagittal crest is considerably lower and the skull seems to have been somewhat shorter proportionately than in that genus.

Homacodon *Marsh.*

Dentition $\frac{?}{?}, \frac{1}{1}, \frac{4}{4}, \frac{3}{3}.$ Upper incisors unknown; canine about equal to p^1 in anteroposterior diameter; anterior premolars probably trenchant and but little spaced.

P^3 triple-rooted, trenchant, with small deuterocone and, in some specimens, a faintly-indicated tritocone; anterior basal cuspule very small; cingulum continuous.

P^4 with large, conical deuterocone, slightly trenchant protocone, prominent antero- and postero-external cuspules and a cingulum continuous except for internal interruption.

M^1 and m^2 quadritubercular with conical cusps, the outer pair slightly trenchant anteroposteriorly, well-developed intermediates and prominent, though small, hypocone, indicated as a well-differentiated conical cusp. In m^3, the hypocone is entirely absent, the posterior intermediate being as large as the protocone in some specimens. Cingula heavy and complete except internally around base of protocone. Prominent parastyle, no mesostyle unless a conical tubercle sometimes seen between the outer cusps in m^3 may be so interpreted; incipient to small metastyle.

Lower incisors unknown but probably three. Canine as large in cross-section as first premolar. P_1 single-rooted, remaining premolars double-rooted, trenchant. P_3 with cingulum-like heel and prominent anterior basal tubercle; p_4 without deuteroconid, but with prominent anterior tubercle and almost as prominent posterior basal tubercle rising from cingulum-like heel. Premolars practically in close series. A short diastema between c and p_1.

Lower molar cusps bunoid internally, slightly buno-selenodont externally, paraconid absent on anterior molars and but feebly developed in m_3; heels wider than

trigonids in m_1 and m_2 and of about the same width in m_3. Hypoconid the largest cusp in the heel; in m_3 hypoconulid slightly smaller than entoconid and all the cusps of the heel high and conical. No internal cingula; slight, discontinuous anterior, external and posterior cingula. Enamel smooth.

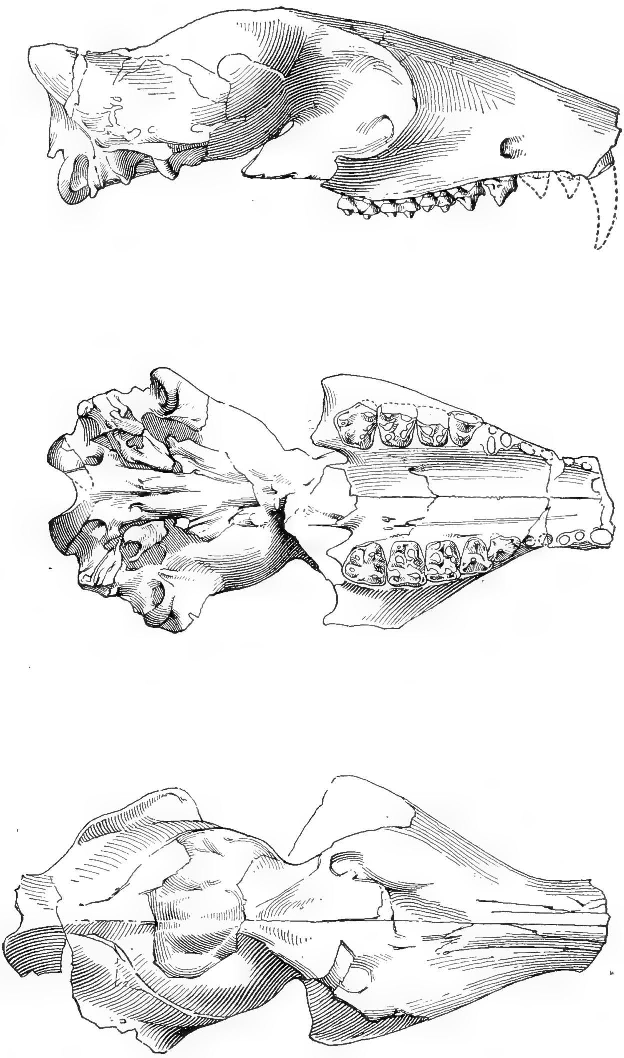


Fig. 19. *Homacodon vagans*, skull, nat. size, side, lower and superior views. No. 12695.

Skull. The skull of *Homacodon,* here figured for the first time, though somewhat damaged, is quite uncrushed. Its salient features may be summarized as follows: —

Basifacial and basicranial axes inclined to each other at a broadly obtuse angle; orbits large, without postorbital processes; temporal ridges low and straight; sagittal crest broken off; brain case depressed posteriorly especially along junction of parietal and squamosal; ossified bulla and auditory meatus absent as in *Dichobune* and *Helohyus* (?) the exposed petrous occupying its place; structure of basicranial region much the same as in *Helohyus* (?)

Homacodon vagans *Marsh.*

Plesiotype. Skull (Amer. Mus. Coll. No. 12695) from the Bridger formation on Henry's Fork opposite the mouth of Burnt Fork, Sweetwater County, Wyoming. Amer. Mus. Expd. 1905.

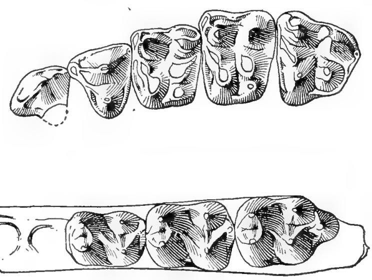


Fig. 20. *Homacodon vagans,* left upper p^4–m^3, twice natural size. No. 12695. Lower m_{1-3}, superior view, twice natural size. No. 12139.

Measurements.

	mm.
Skull, length from anterior border of canine to condyle	71
" width between orbits	24
" " at postorbital constriction	14
" height above m^3	22
c–m^3, length	35
p^3, length	4.5
p^4 "	4.2
m^1 "	4.4
m^2 "	4.9
m^3 "	5.5
p^3 width	3
p^4 "	4.5
m^1 "	5
m^2 "	6
m^3 " anteriorly	6

Generic and specific characters not separable at present.

Nanomeryx *Marsh.*

Original description.— "This genus appears to be nearly related to *Homacodon,* with which it agrees in several respects, but may be distinguished from it by the fact that the fibula is reduced, and coössified distally with the tibia. The lower jaws are more slender and compressed than in *Homacodon,* and there is a short diastema between the canine and the first lower premolar. The bones of the skeleton, even the vertebræ, are very hollow.

The humerus is perforated above the lower condyle, and the inner condylar margin is without the process characteristic of *Homacodon.* The radius and ulna are separate, but the latter bone is quite slender. The fibula is incomplete. The lower part has coalesced entirely with the tibia, but the suture remains distinct, except in very old individuals. . . . .The present species is only about half as large as *Homacodon vagans,* and is thus one of the smallest Eocene Artiodactyles known."

A fragmentary specimen in the American Museum collection (No. 12375, Bridger C1, Twin Buttes, Sweetwater Co., Wyoming, Exp. 1904) agreeing in size with *Homacodon,* has the tibia and fibula fused distally. Another specimen of *Homacodon* has the humerus perforated by a supra-condylar foramen. Until better material is available, *Nanomeryx* may be regarded as rather doubtfully separable from *Homacodon.*

Sarcolemur *Cope.*

It seems probable that this genus, formerly regarded as a primate, should be included among the Artiodactyla and, possibly, referred to the Dichobunidæ, although the artiodactyl type of astragalus has not yet been found in association with the teeth. It may be readily recognized by the development of a prominent deuteroconid on p_4, by the retention of a well-marked paraconid on all the lower molars and by the more strongly marked bunoselenodont character of the outer molar cusps than is found in *Homacodon.*

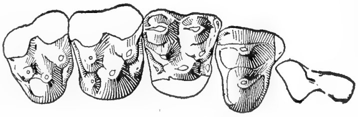


Fig. 21. *Sarcolemur pygmæus,* right, upper p^4–m^3, twice natural size. No. 12043.

A maxillary fragment with p^4–m^3 (Amer. Mus. Coll., No. 12043) from the Bridger formation, C3 on Henry's Fork at Burnt Fork postoffice, Sweetwater County, Wyoming is probably referable to *Sarcolemur* (Fig. 21). P^4 resembles that of *Homacodon,* but the deuterocone is higher. M^1 and m^2

are quadritubercular with a small conical hypocone and a prominent style on the anterior cingulum opposite the notch between protocone and protoconule. A smaller style is found on the outer cingulum of m^1 between the paracone and metacone. This portion of the crown is broken off in the remaining teeth. In m^3 the crown is tritubercular, the metaconule is no larger than the protoconule and the hypocone is absent, unless a very slight elevation of the posterior cingulum is to be interpreted as an incipient (or should it be vanishing?) hypocone.

Measurements.

	No. 12043 mm.
p^4–m^3, length	17.5
p^4, length (approx.)	4.4
m^1 " "	4.9
m^2 "	5
m^3 "	4.8
p^4, width	5.3
m^1 "	5.3
m^2 "	6
m^3 " anteriorly	6

Microsus *Leidy.*

Two mandibular fragments from the Bridger are, apparently, referable to this little known genus. One of them with m_2 and m_3 (Amer. Mus. Coll.,

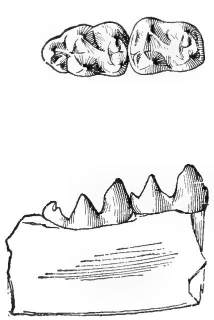


Fig. 22.

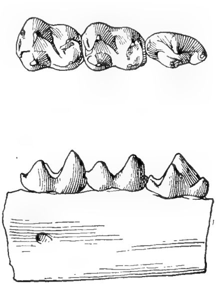


Fig. 23.

Fig. 22. *Microsus cuspidatus*, left m_2 and m_3, superior and inner views, twice natural size. No. 12143.

Fig. 23. *Microsus* sp., p_4–m_2, superior and inner views, twice natural size. No. 12144.

No. 12143, Fig. 22) from Bridger D4, on Henry's Fork at Burnt Fork post-office agrees in size with *M. cuspidatus* while the other one (Amer.

Mus. Coll., No. 12144) from Bridger D4 on Henry's Fork Hill, is smaller. *Microsus* resembles *Sarcolemur* in retaining a large deuteroconid on p_4 but has lost the paraconid on the posterior molars, retaining but a trace of it on m_1 (Fig. 23).

Measurements.

	No. 12143. mm.	No. 12144. mm.
p_4, length		4
m_1 "		3.8
m_2 "	4.9	4.1
m_3 "	5.1	
p_4, width		2
m_1 " across trigonid		2.5
" " " heel		2.9
m_2 " " trigonid	3	2.8
" " " heel	3.5	3
m_3 " " trigonid	3.2	
" " " heel	3.2	

Microsus ? sp.

A fragment of a right half of a mandible with m_{1-3}, from Bridger C5 on Henry's Fork Hill (No. 12145, Am. Mus. Collection) is perhaps referable to *Microsus.* It has a fairly strong paraconid on the first molar, with faint indications of this cusp on the remaining teeth. As the range of cusp variation in this genus is not yet known, the specimen is, for the present, referred doubtfully as above.

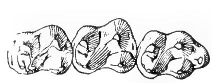


Fig. 24. *Microsus* ? sp., fragment of right mandible with m_{1-3}, superior view, twice natural size, No. 12145.

Measurements.

	mm.
m_1, length	4
m_2 "	4
m_3 "	4.5
m_1, width across trigonid	2.4
" " " heel	2.8
m_2, " " trigonid	2.8
" " " heel	3
m_3, " " trigonid	2.7
" " " heel	2.7

Diacodexis *Cope.*

Dentition $\frac{?}{?}, \frac{?}{?}, \frac{?}{4}, \frac{3}{3}$. Of the upper premolars only the third and fourth are known. P^3 crescentic-trenchant, with small deuterocone and antero-external style; p^4 with large deuterocone and medium sized antero-external style; outer cusp crepcentic-trenchant, inner cusp buno-selenodont; cingulum continuous.

Upper molars tritubercular; hypocone not yet differentiated from cingulum; internal cusp buno-selenodont, external cusps bunoid with trenchant edges. Intermediates well developed. Cingulum interrupted internally on m^1 and m^2, continuous on m^3.

Lower molar cusps bunoid with slight suggestion of buno-selenodont pattern externally. Paraconid usually well developed and present on all the molars (exceptionally absent.)[1] Heels of anterior molars wider than trigonids; in m_3, heel a little narrower than trigonid, hypoconid as large as protoconid, hypoconulid either larger than, or equal to, entoconid.

Mandible with medium inferior convexity, gradually increasing in depth posteriorly.

The type specimen of the genus *Diacodexis* is a composite, originally described as *Phenacodus laticuneus,* and combines upper premolars of *Eohippus,* upper molars of *Hyopsodus* and the last lower molar of an artiodactyl. The lower molar was used by Cope in defining his *P. laticuneus.* Later (1882), the reference of this species to *Phenacodus* was dropped and the new genus *Diacodexis* substituted. As indicated above, the only portion of the type specimen to which this name is applicable is the last lower molar which does not seem to be generically distinct from that of *Trigonolestes.* As the latter genus was not proposed until 1894, *Diacodexis* has priority. Whether *D. laticuneus* is determinable specifically may be open to question, though its generic position is clear. It is of about the same size as *D.* (*Trigonolestes*) *chacensis* and, eventually, may prove to be identical with it.

Diacodexis chacensis *Cope.*

I am wholly unable to separate this species from *D. metsiacus* and *D. brachystomus* on the basis of size nor have I found a single morphologic character whereby they can be differentiated. When taken by themselves, the types seem to differ specifically, but the large series of specimens at my disposal has made it possible to connect them by transitional forms. Eighteen specimens, in addition to the types, were subjected to careful measurement and the results are tabulated below. Completeness of preservation was the sole basis of selection. The series is arranged in the order of increasing length of the tooth row (p_4–m_3) and the value of each dimension given both in millimeters and as a percentage of the length of the tooth row (p_4–m_3), taking the latter as 100.

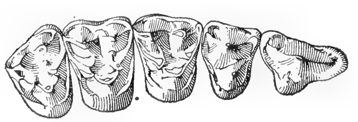


Fig. 25. *Diacodexis chacensis,* right upper p^3–m^3, twice natural size. No. 15671.

[1] As on m_2 in the type specimen of *D.* (*Trigonolestes*) *secans,* where it is hardly visible.

Variation table for Diacodexis (Trigonolestes) chacensis from the Wasatch and Wind River groups of the Bighorn and Wind River Basins, Wyoming.

Am. Mus. No.	Length, p_4–m_3		Length, m_1–m_3		Long diam., p_4		Long. diam., m_3		Depth of jaw at p_4		Depth of jaw at m_3		Horizon
	mm.	%	mm.	%	mm.	%	mm.	%	mm.	%	mm.	%	
15533	17.9	(100)	13.4	(74.8)	4.4	(24.5)	5.4	(30.1)	7	(39.1)	8.3	(46.3)	Wasatch (horizon 2)[4]
15669	18.4	"	13.4	(72.8)	4.9	(26.6)	5.4	(29.3)	6.9	(37.9)	7.5	(40.7)	" (horizon 3)
15666	18.5	"	13.4	(72.4)	5	(27.0)	5.3	(28.6)	7.2	(38.9)	8.1	(43.7)	" "
1535	18.5	"	13.5	(72.9)	5	(27.0)	5.1	(27.5)	6.5	(35.1)	8	(43.2)	" Lower Gray Bull Valley
15522	18.5	"	13.7	(74.0)	4.9	(26.4)	5.4	(29.1)	6.5	(35.1)	7.7	(41.6)	" (horizon 3)
15668	18.8	"	13.3	(70.7)	5.3	(28.0)	5	(26.5)	6.6	(35.1)	——		" "
15671	18.8	"	13.8	(73.4)	5.1	(27.1)	5.8	(30.8)	6.7	(35.6)	8.6	(45.7)	" Shoshone R.
4696[1]	19	"	14.2	(74.7)	4.8	(25.2)	5	(26.3)	6	(31.5)	7	(36.8)	" Bighorn Valley
15527	19	"	14.5	(76.3)	4.5	(23.6)	6.1	(32.1)	7	(36.8)	——		" (horizon 1)
4700[2]	19	"	14.4	(75.7)	4.2	(22.1)	5.4	(28.4)	8.2	(43.1)	9.3	(48.9)	" Bighorn Valley
15523	19	"	14.3	(75.2)	4.7	(24.7)	5.7	(30.0)	7.4	(38.9)	9.3	(48.9)	" (horizon 1)
15521	19.1	"	14.6	(76.4)	4.5	(23.5)	5.1	(26.7)	6.4	(33.5)	——		" (horizon 2)
15524	19.2	"	14.6	(76.0)	4.5	(23.4)	6	(31.2)	7.2	(37.5)	8.2	(42.7)	" (horizon 1)
15672	19.2	"	14.8	(77.0)	5.5	(28.6)	6	(31.2)	7.1	(36.9)	8	(41.6)	" Shoshone R.
15662	20	"	15	(75.0)	5	(25.0)	5.7	(28.5)	8.1	(40.5)	9.2	(46.0)	Lysite, Buffalo Basin
15531	20.2	"	15.2	(75.2)	5	(24.7)	5.7	(28.2)	6.1	(30.1)	7.2+		Wasatch (horizon 1)
15661	20.4	"	15	(73.5)	4.8	(23.5)	5.8	(28.4)	6.9	(33.8)	8.4	(41.1)	Lysite, Buffalo Basin
1559	20.5	"	15.4	(75.1)	4.8	(23.4)	——		8.4	(40.9)	9.4	(45.8)	" " "
4691[3]	20.6	"	15.4	(74.7)	4.8	(23.3)	5.7	(27.6)	——		8.3	(40.2)	Wasatch, Bighorn Valley
297	20.7	"	15.1	(72.9)	5.3	(25.6)	5.9	(28.5)	7.4	(35.7)	8.3	(40.0)	" " "
15520	22.5	"	17.3	(76.8)	5.2	(23.1)	6.5	(28.8)	8.2	(36.4)	——		" (horizon 3)

[1] Cotype of *T. metsiacus*. [2] Type of *T. brachystomus*. [3] Paratype of *T. chacensis*.

[4] Wasatch (horizon 1, 2 etc.) refers to the three horizons in the Bighorn Wasatch (Gray Bull beds) shown in Fig. 2B. Bull. Am. Mus. XXX, Article VII. Horizon 1 is the oldest.

An examination of the table will show that it is quite impossible to draw even arbitrary lines separating the three species recognized by Cope. Nor does the series seem to be varying in any particular direction. Large forms occur both in the Lysite and in horizons 1 and 3 of the Wasatch. Small forms are found in all the Wasatch horizons and in the Lysite also, but the small specimens from the Lysite have been omitted from the table because they were not complete enough to give a full set of measurements.

Diacodexis (*Trigonolestes*) *chacensis, metsiacus* and *brachystomus* may be regarded as variants of a single type illustrating the artificial character of most specific distinctions, which blend as soon as a sufficiently large series of forms is examined. *T. chacensis* was first described, *T. metsiacus* next and, finally, *T. brachystomus* which was later designated as type of the genus. Under these circumstances there may well be some question as to which name should be retained. For the present, *Diacodexis* (*Trigonolestes*) *chacensis* may be used, and *D. metsiacus* and *D. brachystomus* included as synonyms.

Diacodexis olseni n. sp.

Type. A fragment of the right mandibular ramus with p_4–m_2 and half of m_3 (Amer. Mus. Coll. No. 14937). From the Lost Cabin formation (Wind River group), Davis ranch, Alkali Creek, Wind River Basin, Wyoming. Amer. Mus. Exp. 1909. The species is named in honor of its collector, Mr. George Olsen.

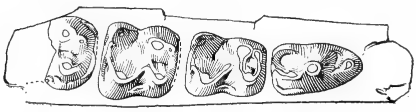


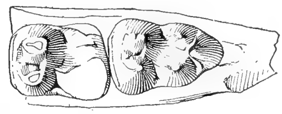
Fig. 26. *Diacodexis olseni*, lower p_4–m_3, superior view, twice natural size. Type specimen. No. 14937.

Measurements.

	mm.
p_4, long diam.	5.6
m_1 " "	4.6
m_2 " "	4.8
p_4 greatest trans. diam.	3
m_1 " " " across heel	4
" " " " " trigonid	3.7
m_2 " " " " heel	4.9
" " " " " trigonid	4.5
m_3 " " " " trigonid	4.7

Additional material may show that this species is connected by intermediate gradations with the larger members of the *D. chacensis* series, but, at present, it is well characterized by the fact that the molars, though of much the same length as in *D. secans* and some of the larger specimens in

the *chacensis* series, are considerably wider transversely than even the largest of these, giving the tooth crown a square outline. The paraconid shows a tendency toward reduction, for it is quite small in m_2, but this may be an individual peculiarity (see note, p. 290). The slight spacing of the molars seen in the figure (Fig. 26) is the result of calcite infiltration into cracks which have spread apart the fractured sections. Readily separable from *Pelycodus*, which it resembles in the square-shaped molars, by the absence of deuteroconid on p_4.

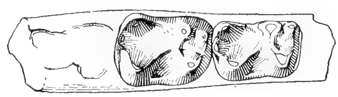


A

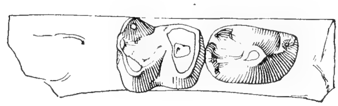
Diacodexis robustus n. sp.

Type. A fragment of the left mandibular ramus with m_2, m_3 (Amer. Mus. Coll. No. 15514). From the Bighorn Wasatch (Gray Bull beds) Lower Gray Bull Valley, Wyoming. Amer. Mus. Exp. 1910.

Additional referred specimens. No. 15510 Am. Mus., maxillary fragment with m^2, m^3, Gray Bull beds, Wasatch (horizon 2) 5 miles south of Otto, Bighorn Co., Wyo.; No. 15511 Am. Mus., part of right mandibular ramus with m_2, m_3, Gray Bull beds, Wasatch (horizon 3), near St. Joe postoffice, Bighorn Co., Wyo.; No. 15512 Am. Mus., mandibular fragment with p_4, m_1, and No. 15513, also a fragment of the mandible with m_1 and m_2, both from the Gray Bull beds, Wasatch, lower Gray Bull Valley, Wyoming.



B



C

Fig. 27. A. *Diadodexis robustus*, left m_2, m_3, twice natural size. Type specimen, No. 15514. B. Right m_1, m_2, twice natural size. Paratype, No. 15513. C. Right p_4, m_1, twice natural size. Paratype, No. 15512.

Measurements.

	No. 15512 Amer. Mus.	No. 15513 Amer. Mus.	No. 15514 Amer. Mus. Type.
	mm.	mm.	mm.
p_4, long diam.	5.9		
m_1 " "	5.3	5.5	
m_2 " "		6	6.3
m_3 " "			7
p_4 trans. diam.	3.7		
m_1, " " across heel	4.4	3.9	
" " " " trigonid	3.9	3.5	
m_2 " " " heel		4.3	4.9
" " " " trigonid		4	4.4
m_3 " " " heel			3.8
" " " " trigonid			4.7

	No. 15510 Amer. Mus. mm.
m^2 long diam. externally	6
m^3 " " "	5.5
m^2 greatest trans. diam.	7.5
m^3 " " "	6.2

A species of *Diacodexis* larger than any previously described Wasatch form is indicated by various fragmentary specimens collected by the American Museum Expedition of 1910. The teeth are wider both anteroposteriorly and transversely and the jaw heavier than in the largest member of the *chacensis* series. From *D. olseni* it is readily distinguished by the greater anteroposterior diameter of the molars in proportion to their width.

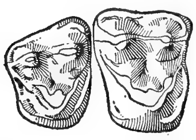


Fig. 28. *Diacodexis robustus*, right upper m^2, m^3, twice natural size. Paratype, No. 15510.

The two upper molars referred to *D. robustus* (No. 15510, Fig. 28) do not differ, except in size, from the corresponding teeth in the other species of *Diacodexis* in which the upper dentition is known.

Relationships of the American Dichobunids.

The resemblance in tooth pattern of the American genera here described to the European dichobunids and, especially, the close agreement in basicranial structure of *Dichobune*, *Helohyus* (?) and *Homacodon*, renders it highly probable that the closely allied American genera *Wasatchia*, *Bunophorus*, *Helohyus*, *Lophiohyus* and *Homacodon* should be referred to the Dichobunidæ. *Diacodexis* should also, probably, be included in this family. Though somewhat larger than *Protodichobune*, *Wasatchia* shows a considerable degree of resemblance to a specimen figured by Stehlin [1] from the Upper Ypresien of Monthelon near Epernay and provisionally determined as *Protodichobune*. Less certainty exists regarding the systematic position of *Sarcolemur* and *Microsus* which are referred to the Artiodactyla on dental characters only and may, for the present, be classed as dichobunids. Owing to the fragmentary character of the available material, it is unsafe to dogmatize on matters of phylogeny, but several divergent lines of evolution appear to be indicated. A close relationship seems to exist between the Lower Eocene genus *Wasatchia* and the Middle Eocene *Helo-*

[1] Stehlin. Die Saugetiere des schweizerischen Eocaens, Vierter Teil, Abhandlungen der Sch. Pal. Gesellschaft, XXXIII, fig. xciii, p. 668, 1906.

hyus and *Lophiohyus,* perhaps sufficiently close to warrant the inference that the latter are derived from the former. *Bunophorus,* a contemporary of *Wasatchia,* has diverged from the *Wasatchia-Helohyus* line in the loss of the paraconid in the lower molars. Unfortunately, the upper dentition of this form is unknown so we cannot be sure of its relationship to *Homacodon* which has also lost the paraconid in the lower molars, or almost so. *Homacodon* departs from the structure of the last upper molar found in *Wasatchia* and *Helohyus* in the enlargement of the metaconule, thereby developing a quadritubercular crown in which the undeveloped or lost hypocone takes no part. It may, perhaps, represent still another divergent evolutionary line, though from the fact that its Lower Eocene predecessors are unknown, this is uncertain. *Diacodexis* (*Trigonolestes*) differs from all its contemporary artiodactyls, so far as known, in the trigonodont character of the upper molar crowns. I am not prepared to add anything to Stehlin's suggestion that it could, possibly, represent the stem-group of the dichobunids, with nearer relationships to *Protodichobune.* Finally, in *Sarcolemur* and the allied *Microsus* still other variations appear in the development of a large deuteroconid in p_4 coupled either with the presence or the absence of a paraconid in the lower molars. It is, perhaps, among the members of this last group, rather than in *Homacodon,* that the ancestor of the Unita selenodonts is to be found.

55.1.78(78.9)

Article XXII.— PALEOCENE DEPOSITS OF THE SAN JUAN BASIN, NEW MEXICO.

By W. J. Sinclair, Princeton University, and Walter Granger, American Museum of Natural History.

Plates XX–XXVII.

CONTENTS.

Introduction.

A double interest attaches to the Paleocene formations of northwestern New Mexico because the oldest Tertiary mammal fauna so far discovered has been obtained from these beds and because it is possible to establish definitely the stratigraphic position of this fauna with reference to underlying dinosaur-bearing horizons.

The first collections from what are now known as the Puerco and Torrejon formations were made by David Baldwin for Professor Cope, from 1881 to 1888 and are now in the American Museum. They were further supplemented by the American Museum expeditions of 1892 and 1896 under Dr. Wortman, but although a considerable amount of material was thus acquired, little was known of the stratigraphic relationships of the fossiliferous beds, either to each other or to the rocks on which they rest, and but little more of the precise levels from which the collections were obtained. The most complete account of the stratigraphy hitherto published appeared in an article by Dr. J. H. Gardner in the December number of the Journal of Geology for 1910: "The Puerco and Torrejon Formations of the Nacimiento Group." Dr. Gardner's observations, however, cover only a portion of the two formations, and were made without the aid of sufficient palæontologic data.

Believing that valuable palæontologic and stratigraphic data could be acquired by a reëxamination of this field, the American Museum began in 1912, under Mr. Granger's direction, with the exploration, by a small party, of a portion of the Torrejon. Continuing in 1913, from the middle of June until early in October, with the party strengthened in numbers and equipment, a very careful examination of all of the fossiliferous area of both the Puerco and Torrejon was made. The result of the two seasons' work has been the securing of a collection which, in point of numbers and in completeness of the material, exceeds all previous collections from the Paleocene of this region.

Some time must elapse before the palæontological results are ready for publication. The geological data secured by the expedition are presented on the following pages.

Itinerary.

The route of the expedition can readily be followed on the accompanying sketch-map, on which the localities where collections were made are indicated by numbers. Outfitting at Farmington on the San Juan River with Mr. Jack Martin of Farmington as cook and teamster and Messrs. Granger, Olsen and Sinclair as collectors, we proceeded southeasterly to Simpson's store on the Gallego, thence by way of Reidner's store, also on the Gallego, to the vicinity of Chico Springs, where a small collection of Torrejon fossils was made from two exposures about half a mile apart at the head of Chico Arroyo. Having located from here the fossiliferous horizons of the Puerco, operations were transferred to the vicinity of Barrel Spring and Ojo Alamo where a large collection was obtained from the upper-

most of the two Puerco levels, which, as will appear later, is characterized by numerous, but mostly fragmentary, remains of *Polymastodon*. Here also the relation of the Puerco to the underlying beds with dinosaurs was found to be exhibited with diagrammatic clearness. The discovery of Torrejon fossils in the section exposed in Barrel Spring Arroyo made possible a measurement of the thickness of the Puerco (see Section A, Fig. 2).

Having gathered all the fossils we could find, several camps were made some miles to the southeast on the west branch of Kimbetoh Arroyo and on Kimbetoh Arroyo at the old Dolan ranch (ruins only) about four miles above the United States Government stock-man's station at Kimbetoh. Here a surprising amount of material was collected from a lower fossil level in the Puerco, some twenty-seven or more feet above the base of this formation, and also from the Torrejon formation exposed in bluffs at the heads of the arroyos just mentioned (see Section B, Fig. 2). The fossils from the head of Kimbetoh Arroyo were afterwards found to be from a horizon one hundred feet below the level at which Torrejon fossils had hitherto been known to occur in the typical locality on Torrejon Arroyo. An exceedingly dry season, affecting water and range, made it necessary to postpone an examination of the Escavada Wash exposures and operations were transferred to the cliffs at the head of the east and west forks of Arroyo Torrejon where both fossil levels of the Torrejon formation gave most gratifying returns. From here, a brief excursion was made eastward to the Wasatch exposures in the vicinity of Ojo San Jose north of Nacimiento (Cuba) where scarcity of fossils, continuous rain and the proximity of typhoid induced us to return toward the head of Escavada Wash, collecting at intervals from the Torrejon formation along the line of cliffs which extends almost continuously from the Puerco River to the head of Escavada and beyond to the northwest. Some small Torrejon exposures in Blanco Cañon were also examined and the return trip to Farmington made by way of Chico Springs, Ojo Alamo and Pina Veta China to complete the examination of the southwestern margin of the Puerco.

Structural Relationships; Location of Exposures.

The Paleocene formations of northwestern New Mexico occupy the center of a structural basin, about the margin of which appear the coal-bearing and other members of the Cretaceous. The dips of the Tertiary formations are, in general, toward the center of the basin. Exposures of both Puerco and Torrejon are confined to its south and southwest margin by the overlap of the basal sandstone of the Wasatch, which completely

conceals the Paleocene to the north and northeast, so far as at present known to the writers.

Although the type section of the Puerco examined by Cope is that along the Puerco River (Plate XXVII, Fig. 1) this formation may be studied to best advantage in the vicinity of Ojo Alamo, on various branches of Kimbetoh Arroyo three to four miles northeast of Kimbetoh, and on a large arroyo between Kimbetoh and Escavada Wash. Farther to the southeast, the broadening of the arroyos and the configuration of the topography prevent the occurrence of exposures of the lower part of the formation, so that on the Rio Puerco only the upper part of the Puerco is exposed, most of Cope's Puerco being referable to what is now called Torrejon (see Section D, Fig. 2). The Torrejon is well exposed in the face of the escarpment at the heads of Kimbetoh Arroyo, Escavada Wash, Alamo and Alamito Arroyos, and on both the east and west forks of Arroyo Torrejon, with small exposures in Blanco Cañon and considerable, though locally fossiliferous, areas about Chico Springs. The relation of the Puerco to the beds on which it lies may be studied to best advantage in the vicinity of Ojo Alamo.

Pre-Puerco Formations.

In 1904, Mr. Barnum Brown collected for the American Museum some dinosaur remains in the vicinity of Ojo Alamo from shales beneath a conglomerate overlain unconformably by the Puerco. To "the shales below the conglomerate that contain numerous dinosaur and turtle remains" he gave the name Ojo Alamo beds, estimating their thickness as about 200 feet. In a note published by Dr. F. H. Knowlton,[1] Dr. J. H. Gardner claims to have found dinosaurs above the unconformity at the top of what the United States Geological Survey calls "Laramie" and "thus apparently of Puerco age" (Knowlton). It was, therefore, with considerable interest that the study of the stratigraphic relationships of the base of the Puerco was approached. Fortunately, no better sections could be desired than are found in Ojo Alamo and Barrel Spring Arroyos and on the various branches of Kimbetoh Arroyo. The contacts are clearly exposed and fossils are sufficiently abundant a few feet above and below them to afford data for age determinations. A discussion of the basal relationships of the Puerco will be limited to these sections (A and B, Fig. 2).

Conglomeratic Sandstone with Fossil Logs:— Along its southern and

[1] Proceedings of the Washington Academy of Sciences, Vol. XI, p. 232, footnote 47, August, 1909.

southwestern margin, the Puerco formation rests, with marked erosional unconformity, on a coarse, cross-bedded, conglomeratic, yellow-brown sandstone containing, toward its top, many large silicified logs lying prone and often invested in a capsule of indurated sand. The finer material of this sandstone is mostly angular quartz and feldspar, barely coherent. The pebbles are water-worn and chatter-marked, and comprise quartzite, jasper and various volcanics. It seems to represent material swept into the basin of accumulation by floods, perhaps during an interval of crustal uplift which stimulated the streams to carry down the gravels which had accumulated in their channels and to undermine their banks, destroying the large trees growing there. Some of these drift logs are two or three feet across and over 50 feet long. The branches and bark have been stripped off (foreground, Plate XXI). The centrum of a dinosaurian caudal vertebra was found, loose on the surface, by Mr. Jack Martin of the expedition, resting on this sandstone near the edge of Split Lip Flat, in the immediate vicinity of Barrel Spring. It was not in place, but it seems hardly probable that it had been carried to the spot where it was found by the Indians, who are afraid of fossil bones. Some may question its value as an index fossil. To us it seems probable that it had weathered out of the sandstone, as did the fragments of silicified logs lying about in its vicinity. It is badly worn and lacks the arch. This sandstone member varies in thickness from 28 to 66 feet.

Shales with Dinosaurs, Upper Horizon.— The sandstone varies in thickness because of the erosional unconformity at its top (Plate XXII) which will be discussed later. At its base it rests disconformably on a series of rusty-yellow, bluish, greenish and wine-red, banded clays with lenses of yellow channel sandstone, the Ojo Alamo beds of Brown. The disconformity between these clays and the heavy sandstone member above is no greater than usually occurs throughout the Puerco and Torrejon formations between sandstone channel-fillings and the clays in which they are cut. The clays are banded with a fair degree of regularity (Plate XX, Fig. 2) except where interrupted by the channel sandstones. A maximum thickness of some 58 feet was measured for this member (Sect. A, Fig. 2). It rests conformably on a conglomerate, the sandy matrix of which merges gradually upward with some of the sandstone lenses interstratified with the clays. A few feet above the conglomerate is a level characterized by abundant, but badly crushed, dinosaur bones, ceratopsian, trachodont and carnivorous, also turtles, crocodiles and garpikes. This seems to be the level of Brown's *Kritosaurus navajovius.* Much silicified wood strews the surface of the bone-bearing level and of the slopes above, but it seems to come from the overlying sandstone with silicified logs.

Lower Conglomerate.— The conglomerate below this dinosaur-bearing

horizon varies from a pebbly sandstone to a coarse conglomerate with waterworn chatter-marked quartzite, jasper, andesite and porphyrite pebbles. Sometimes it is incoherent, with a white clay-like substance feebly bonding together angular quartz and feldspar grains and the pebbles, but in other places it is cemented to form a rusty-yellow and fairly hard rock, which caps several mesas about a mile and a half below Barrel Spring. This formation has been observed only between Ojo Alamo and Barrel Spring Arroyos. It was traced southeasterly along the outcrop until it passes under ground in Barrel Spring Arroyo a few hundred yards above a point directly opposite the spring, which issues from beneath the conglomeratic sandstone with fossil logs. Its source has not been traced. Its thickness varies from 6 to 8 feet.

Shales with Dinosaurs, Lower Horizon.— This lower conglomerate lies, in its turn, disconformably on a series of bluish shales or, rather, clays, for they are quite incoherent. Lignite is sometimes present below the contact with the conglomerate and to the southwest of Barrel Spring, the top of this formation, for some feet below the conglomerate, is beautifully banded, wine-red strata alternating with bluish-gray. Dinosaur bones and silicified wood, both in place, occur throughout this banded zone. We did not ascertain how far below this level vertebrate fossils are found in these bluish-gray clays, but a trip down Ojo Alamo Arroyo to a point some eight miles below the store resulted in finding turtle and other reptile bones in shales apparently conformable with those just mentioned, so far as we could judge from rather hastily made observations. The only interruption to shale deposition seemed to be a prominent stratum of yellow-brown sandstone exposed some three miles below the store, in Ojo Alamo Arroyo, but this seemed to be conformable with the shales both above and below. Material is not yet available for determining whether the dinosaurs in the shales below the conglomerate differ from, or are identical with, those above it.

Age of the Ojo Alamo Beds.— The age of the Ojo Alamo dinosaur beds is in dispute. Mr. Brown has regarded them as certainly older than the Lance and probably correlative with the Edmonton Cretaceous. He has examined part of a trachodont maxilla collected a few feet above the conglomerate separating the two horizons at which dinosaur bones were found, also various teeth of carnivorous dinosaurs from above and below the conglomerate, obtained by the 1913 expedition and reports as follows:

"The reptilian and fish remains from the Ojo Alamo beds collected by the American Museum Expedition of 1913 are for the most part too fragmentary for specific determination. Even generic determination of isolated dinosaur teeth and bones must be considered a provisional reference. The collection is identified as follows:

Kritosaurus navajovius Brown	maxillary and fragments of skull
?*Kritosaurus* sp.	dorsal centrum
?*Deinodon* sp.	separate teeth
Crocodile	tooth
Lepisosteus sp.	scales

"The Trachodont dinosaur *Kritosaurus* is of especial interest in its bearing on the age of the beds.

"This genus was founded on an incomplete skull from Ojo Alamo collected in 1904. Bull. Am. Mus. Nat. Hist., Vol. XXVIII, Art. xxiv, pp. 267–274, 1910.

"In the type specimen the left nasal was preserved but without contact to contiguous parts. Its extraordinary form was at the time considered in part due to crushing and was not placed in the restored skull.

"Recently Mr. Lawrence M. Lambe, Ottawa Naturalist, Vol. XXVII, No. 11, Feb., 1914, described a perfect skull from the Belly River beds of Canada under the name *Gryposaurus notabilis.* In all respects, including the remarkable development of the nasals, premaxillaries and predentary and reduction of the orbital portion of the frontal, this skull agrees with the type of *Kritosaurus* and there is no doubt of its generic identity.

"The fauna of the Ojo Alamo beds is certainly older than that of the Lance and I have expressed the opinion that it was probably synchronous with the Edmonton. *Kritosaurus* is now known from the Belly River beds and has not yet appeared in extensive collections from the Edmonton, and as other reptilian remains are of primitive facies the Ojo Alamo beds may well be of Judith River Age.

"The Ojo Alamo fauna now known is as follows:

Kritosaurus navajovius Brown.
?*Monoclonius* sp.
?*Deinodon* sp.
Thescelus rapiens Hay.
Crocodile
Lepisosteus sp."

Mr. Gilmore has pronounced the dinosaur remains collected by Dr. Gardner from what he supposed to be the Puerco, but what is in reality Ojo Alamo, to be "a typical Ceratops-beds fauna."

Mr. Willis T. Lee favors a correlation of the dinosaur beds and associated conglomerate members with the Animas formation. If the Animas is, in turn, to be correlated with the Lance, which Dr. Knowlton regards as Tertiary, then the line between Cretaceous and Tertiary in the Ojo Alamo

region would have to be drawn by those who favor Dr. Knowlton's contentions, not at the unconformity below the Puerco where the vertebrate palæontologist would be inclined to put it, but at some level not yet discovered.

Our instructions and the object for which the expedition of 1913 was organized prevented us from devoting the necessary time to a study of the stratigraphy and palæontology of the Ojo Alamo beds, but parts of several days were spent on it by various members of the party. Not one fragment of dinosaur bone did we find above the level of the unconformity at the top of the conglomeratic sandstone with fossil logs. Whatever may be the final conclusion regarding the age of the Ojo Alamo beds, we feel reasonably certain that dinosaurs will not be found to occur in the Puerco.

The Puerco Formation.

Basal Unconformity.— The Puerco clays rest unconformably on the eroded surface of the conglomeratic sandstone with fossil logs (Plate XXII). Low hills of the sandstone rise like islands through the horizontally-banded clays of the lower Puerco levels. Shallow valleys between the hills are filled with rusty-weathering blue clays, sometimes with lignite pockets in the bottoms of the depressions (Section B, Fig. 2). The unconformity is not a mere local feature. It has been traced from Pina Veta China (see map, Fig. 1) almost to Escavada Wash and would have been followed farther if the fossiliferous levels of the Puerco had been exposed beyond this point. It marks the beginning of a new deposition cycle, a *sudden* change from coarse sandstone and conglomerate to fine clays which first fill depressions in the sandstone, then completely blot out the old erosion surface under sheet upon sheet of clay with, occasionally, a stray bit of drift timber or a lens of sand, but not a single pebble. An abrupt faunal change occurs at the unconformity, from conditions favoring dinosaurs [1] to those responsible for a great radiation of Paleocene mammals, present in abundance throughout a horizon of limited thickness in the Puerco approximately 30 feet above the unconformity. For these reasons it seems to us to be the dividing line between Cretaceous and Tertiary in this region.

The Puerco Sediments.— Facial changes in the strata composing the Puerco formation occur so rapidly that any detailed discussion of particular sections would be quite unprofitable (compare sections A and B, Fig. 2). In general, the Puerco consists of unconsolidated clays, often brilliantly color-banded, and channel sandstones, also unconsolidated or but slightly

[1] One dinosaur vertebra found in the sandstone. See p. 301.

coherent, which cut across the clays (Plate XXV, Fig. 1). Beds of lignite or lignitic clay (Plate XXIII, Fig. 2) and deposits of oxide of manganese in irregular sheets and concretionary masses (Plate XXIV) further diversify the formation. When viewed from a distance, the Puerco exposures seem to be regularly banded (Plates XXI, XXVI), but when examined in detail great local irregularity in bedding is found to occur, with a marked tendency toward cross-bedding, and with rapid facial changes laterally not only from sandstone to clay, but from clay of reddish to that of bluish or yellowish tinge or the reverse. Much fossil wood occurs locally, silicified drift logs and pieces of lignitized wood looking like charcoal are scattered irregularly through the clays. Nodules, sheets and veins of barite are also common features.

Certain members of the lower part of the Puerco in the Ojo Alamo and Kimbetoh Arroyo sections deserve more detailed consideration because of their conspicuous colors, peculiar lithology, or their relation to the two levels at which fossil mammals occur.

1. *Ojo Alamo Section.*— In the vicinity of Barrel Spring and Ojo Alamo, a three-foot stratum of clay, mottled red and green, rests unconformably on the top of the conglomeratic sandstone with petrified logs (Plate XXII) which sometimes rises through it as small hills, and sometimes is separated from it by shallow valleys filled with bluish and rusty-colored clays. After an interval of 13 feet, or more, of bluish clays a second prominent zone of greenish-mottled red clays occurs (Plate XXIII, Fig. 2), $13\frac{1}{2}$ to $15\frac{1}{2}$ feet thick. Towards the top of this zone, some jaw fragments and a much distorted skull of the genus *Ectoconus* were collected and locally numerous turtle and crocodile fragments were noted. Wortman's field letter to the American Museum, written under date of March 28th, 1892, from the head of Coal Creek, places his lower horizon affording Puerco fossils at 20 feet above the Laramie (10 or 15 feet according to the notes he published later). We, therefore, regard the upper levels of the second red zone as the lower fossil level of Wortman. Except for the specimens noted and some fragments of turtle carapace, nothing was collected from it in the vicinity of Ojo Alamo, but farther to the southeast a large collection was assembled from the same horizon, as will be discussed in the following section. Above this red clay zone are various clays of bluish or yellowish color intersected by gray sandstone channel-fillings, above which are one or more narrow bands of wine-red, greenish-mottled clay. In Barrel Spring Arroyo, the top of this third reddish zone is 46 feet, 6 inches above the top of the second red zone. Along the contact of the red clay with an overlying greenish clay abundant, but fragmentary, mammal bones occur, an assemblage characterized by the presence of *Polymastodon* which was not found at any other level. This is

Wortman's second horizon which he estimates, both in his field letter and published notes, to be 30 feet above his lower fossiliferous horizon. In Ojo Alamo Arroyo, the *Polymastodon* fauna occurs in two (or more) wine-colored clay bands separated by bluish clays, totaling $8\frac{1}{2}$ feet in thickness and separated from the second reddish zone by bluish clays and channel sandstones aggregating 33 feet. These differences are due in part to local variations in the thickness of the beds. Altogether there is a difference of only 5 feet between the highest levels at which *Polymastodon* was found.

A peculiar feature of the gray channel sandstones below the upper fossil level of the Puerco is the presence of cylinders, spherical aggregates and irregular sheets of oxide of manganese (Plate XXIV). The contrast of the black beds and concretionary masses of manganese against the gray of the sandstone channels is most conspicuous. Leaf impressions were found in some of the sheet deposits, in a matrix of sand, manganese oxide and perhaps a little lignite, and at one locality on the south side of Barrel Spring Arroyo a small collection of rather poorly preserved impressions was made from several sheets of manganese oxide in channel sandstone, a little below the level of the upper fossil horizon of the Puerco (Plate XXIV). These were submitted to Dr. F. H. Knowlton who reports as follows: —

"With a fair degree of probability I am able to identify the following species:

Ficus occidentalis Lesq.
Artocarpus sp. ined.
Paliurus zizyphoides? Lesq.
Viburnum lakesii? Lesq.
Platanus sp. cf. *P. haydenii* Newb.
Populus cf. *P. cuneata* Newb.
Viburnum sp.?
Fragments.

"The *Ficus, Paliurus* and *Viburnum lakesii* are species of the Denver and Raton formations. The *Artocarpus* is the same, apparently, as an undescribed species from the Raton formation, while the others, if correctly identified, should indicate Fort Union.

"While I cannot be very positive about it, so far as I can determine from the imperfect material available, the age indicated is that of the Denver or perhaps as late as Fort Union. This is apparently of the same age as material obtained last year by Dr. W. T. Lee near Pagosa Junction, Colorado."

This is the first collection of fossil plants to be made from the Puerco, and is in no way opposed to a reference of the formation to the Paleocene,

but we do not feel that it is sufficient to justify any correlation of the Puerco with formations elsewhere in which the Puerco types of mammals have not been found. Least of all do we think that it should be used as proof of contemporaneity with certain formations containing dinosaurs (Lance, Denver) from which the Fort Union flora is reported, but this is not the place to discuss controversial matters.

With the exception of a fourth wine-red clay band $125\frac{1}{2}$ feet above the upper fossil level, the remaining beds in the Ojo Alamo section, for the present referred to the Puerco, are a monotonous succession of clays with occasional channel sandstones. Two of these channels, intersected by Barrel Spring Arroyo, are quite thick, but rapidly thin out laterally and are replaced by clays. Above the uppermost of these two sandstone channels, three specimens of *Periptychus rhabdodon,* a characteristic Torrejon species, were collected (Sect. A, Fig. 2) and from this level upward the beds are regarded as Torrejon, but there is no visible stratigraphic break between them and the underlying Puerco unless the disconformity at the base of the channel sandstone on which the clays with *Periptychus rhabdodon* rest may be so regarded, and this disconformity cannot be followed beyond the edge of the sandstone channel.

2. *Kimbetoh Arroyo Section.*— Some 12 miles to the southeast, in a straight line, extensive exposures of the Puerco are found on Kimbetoh Arroyo and its branches and on a nameless arroyo between Kimbetoh and Escavada Wash. Here considerable facial change in the character of the lower Puerco sediments is noticeable (compare Sections A and B, Fig. 2). The first red clay has disappeared. The second is largely replaced by slate-colored and bluish clays, but the level of the first fossil horizon is quite constant, and along the contact of a dark slate-colored clay with bluish clays and cross-bedded sandstones above, a surprising amount of material was obtained, including an almost complete skeleton of *Ectoconus* and several creodont and other skulls. Fossils range through a greater thickness of beds here than farther to the northwest, the highest specimen occurring 22 feet above the zone of greatest abundance. In all this assemblage of scores of specimens, there is not a single fragment referable to *Polymastodon.* The remaining beds, to the level of the first Torrejon fossils, are monotonous in character, sands and clays much more irregular in stratification than would appear from the somewhat diagrammatic sections here given. The presence of abundant concretion-covered crocodile, turtle and fish remains near the top and base of a thick clay member below the level of the first Torrejon fossils is a feature peculiar to the Kimbetoh area. Whether they should be referred to the Puerco or the Torrejon does not appear, for the remains are either too fragmentary or not sufficiently

characteristic. For the present, the boundary has been drawn here, as in the Ojo Alamo section, at the level of the first occurrence of *Periptychus rhabdodon.*

Thickness of the Puerco.— The Puerco is not separated from the overlying Torrejon by any lithologic or stratigraphic break which we could detect. We have referred to the Puerco that portion of the series of Paleocene sands and clays between the basal unconformity and the lowest level at which Torrejon fossils have been found. In Barrel Spring Arroyo, one specimen of the Torrejon species *Periptychus rhabdodon* was found at the top of a dark slate-colored clay abounding in turtles, crocodiles and gar-pikes, and two in clays immediately above this stratum some 245 feet 6 inches above the unconformity at the base of the Puerco. In the Kimbetoh Arroyo section a thickness of beds 336 feet 6 inches (more or less) occurs between the basal unconformity and the level of a specimen of *P. rhabdodon,* also associated with turtles, crocodiles and fish and lying 45 feet below the lower fossil level of the Torrejon, to be described later. Further collecting may carry the level of Torrejon fossils still lower, so that it is unsafe to infer unconformable relationships from the differences in thickness of the Puerco in the two sections measured by us.

In the Arroyo Torrejon section of Dr. Gardner (Section C, Fig. 2), the full thickness of the Puerco is certainly not exposed. Of the 210 feet referred by him to that formation, 100 feet is now known to belong to the Torrejon because Torrejon fossils in abundance are found at the point indicated in the section (Sect. C, Fig. 2) 100 feet below his Puerco-Torrejon contact. The remaining 110 feet is exposed in the lower line of cliffs along the east and west forks of Torrejon while the greater portion of the formation is concealed beneath dune sand and fine wind-blown silts in the broad desert valley between the cliffs and Encino Spring.

In the Puerco River section (D, Fig. 2) Gardner's 558 feet of Puerco is reduced to 179 feet by the discovery of Torrejon fossils immediately above the 30 foot bed of sandstone (third member above the base in his Arroyo Torrejon section) which Dr. Gardner correlates with a 40 foot stratum of sandstone (fourth member above base) in his Puerco River section. The fossil level has not, however, been traced that far east, but the sandstone below it can be readily followed. We have not examined the contact of the Puerco with the Lewis shale indicated in Gardner's section. If the relationship is as indicated it is possible that the lower levels of the Puerco have been concealed by overlap of higher horizons.

Fossil Levels; Origin of the Puerco Sediments.— The position of the two levels in the Puerco affording fossil mammals has already been indicated. The lower is characterized by many individuals referable to several genera

and species of the family Periptychidae; the upper has afforded all the specimens of *Polymastodon* collected by us. So far, no mammals have been obtained from any other horizon in this formation. Why this is so is by no means apparent.

The presence of fish, crocodiles and turtles (*Trionyx* and other genera) in the same stratum and at the same level with mammal bones shows conclusively that these deposits have been formed by water. Lignitized plant rags and pieces of silicified drift wood with the bark worn off, found stranded in the fine clay of the fossil horizons, tell the same story. The presence of cross-bedding inclined at low angles, (except in the sandstone channels) and the frequent occurrence of the latter cutting clays speak eloquently for accumulation on river flood plains or on the surfaces of broad, low-grade, coalesced alluvial fans. That the streams were low-grade is shown by the complete absence of pebbles in the Puerco, and by the horizontal extent of some of the clay bands. Bogs, apparently occurring in backwaters in the channels or in depressions between the fans became filled with accumulations of oxide of manganese, preserving impressions of the leaves of figs (*Ficus*), plane trees (*Platanus*), poplars (*Populus*), relatives of the breadfruit (*Artocarpus*), and various shrubs, (*Paliurus, Viburnum*) which, together with the frequent large drift logs in the clays (Plate), may be taken as indicative of a heavy growth of vegetation along the streams and, presumably, in the interstream areas also. Whatever deposits of mud or sand were accumulated by the streams would form in the permanently or temporarily submerged portions of the basin of accumulation traversed by the streams. Such continuous strata as the dark slate-colored clay below the fossil zone in the Kimbetoh area may represent an old vegetable soil on the surface of a broad fan or an accumulation in a fan-delta lake basin which was filled by the deposits of a shifting stream (the cross-bedded sands and clays in which the mammal bones are found). We have not observed any indications of aridity.

The mode of occurrence of the fossils may throw some light on the origin of the deposits in which they occur. Lack of association of parts is the rule. Maxillæ, jaws, and teeth, the most resistant parts of the skeleton, greatly predominate in the collections. Rarely is the skull found with other skeletal parts and only once has an almost complete skeleton been discovered. Occasionally a well preserved skull or other strong bone may be found in one of the channel sandstones interrupting a fossil level. In damp woods, the bones of animals would eventually decay and only in water-laid sediments would there, probably, be an accumulation of the more resistant parts representing an epitome of the fauna of the region. Some of these bones might have been washed into the streams during heavy rains; many, no doubt, are the remains of creatures mired and drowned at drinking

places; others may be from animals dragged into the water by crocodiles, while the activities of these animals and of carnivorous turtles and fish perhaps help to explain the wide scattering to which the remains of Puerco mammals have been subjected. A quarter, at least, of the Puerco specimens, collected by the 1913 expedition, show traces of gnawing, probably by small plagiaulacids. This undoubtedly proves that many of the bones lay for some time on the surface of the ground before they found their way into the streams or were covered in flood time by water-borne sediments.

The origin of the red color of some of the clays has not been looked into chemically, but from the occurrence of fish, turtles and crocodiles in the red bands of both the Puerco and Torrejon it would seem that they are water-deposited and, perhaps, owe their red color to subsequent dehydration on drying.

The Torrejon Formation.

The larger part of Cope's Puerco River section (D, Fig. 2 and Plate XXVII, Fig. 1) is now referred to what Dr. Wortman called the Torrejon formation. No fossils were found by Cope in this section nor did any of Baldwin's collections come from here.[1] When Wortman discovered the presence of two Puerco levels in the Ojo Alamo exposures and a higher level (upper fossil level of the Torrejon) in the cliffs at the head of the branches of Arroyo Torrejon, he did not wish to announce that he had discovered something older than what had up to that time been called the oldest Tertiary, so retained the name Puerco for the oldest beds in which he found fossils and gave a new name, Torrejon, to the higher levels which are now known to make up the largest part of Cope's original Puerco.

The Torrejon Sediments.— The Torrejon closely resembles the Puerco in the character of its materials except for the appearance of gravels (quartzite, jasper, red shale, &c) in some of the channel sandstones. At the type locality on the east and west forks of Arroyo Torrejon, where it is exposed in the face of a cliff capped by the basal sandstone of the Wasatch, it differs from the Puerco in having two zones, 100 feet apart, characterized by an abundance of small, rusty, calcareous concretions (Plate XXVII, Fig. 2). It is in these concretionary zones that the fossils occur. The color of the concretion-bearing clays varies from red mottled with green to gray. In the exposures along the Torrejon, a heavy persistent sandstone lies below

[1] So far as we could ascertain from Baldwin's partner, Thomas Rafferty of Farmington, New Mexico, who acted as guide and teamster for Wortman's first expedition, Cope's collections as well as those of the 1892 expedition were secured largely in the vicinity of Chico Springs (Torrejon), head of Coal Creek (*i. e.* Ojo Alamo and Barrel Spring vicinity, Puerco), and on Kimbetoh Arroyo (Puerco and Torrejon).

the lower fossil horizon (see next paragraph), but whether it is referable to the Puerco or the Torrejon is, for the present, doubtful. In other respects, there is so little difference between these formations that in the absence of fossils it is, at present, impossible to tell them apart.

Torrejon Fossil Levels.— From the important part which fossils must play in locating the lower boundary of the Torrejon formation it seems advisable to consider, in this place, the fossil levels. Previous to 1913, Torrejon mammals were known to occur in but a single horizon, which in the type locality is a zone of gray (sometimes reddish) clay abounding in rusty concretions (upper fossil level of Sections B and C, Fig. 2 and Plate XXVII, Fig. 2) and affording remains of *Euprotogonia, Periptychus rhabdodon, Pantolambda* and other characteristic Torrejon forms. At the base of this zone, Dr. Gardner placed his boundary between the Puerco and the Torrejon (see Sect. C, Fig. 2). We have found that a second fossil horizon occurs in the type section, with *Euprotogonia* etc., exactly 100 feet below the former. From both, extensive collections of splendidly preserved material were made and both were traced by almost continuous outcrops from the East Fork of Arroyo Torrejon to the west branch of Kimbetoh Arroyo (see map, Fig. 1). Some small exposures of the upper horizon in Blanco Cañon were also examined. Neither level has been found in the Rio Puerco section, apparently dying out laterally, while to the northwest, in the Ojo Alamo section, a heavy yellow sand-stone (? basal Wasatch?) rests unconformably on the Torrejon clays, cutting out the levels at which the two fossil layers might be expected to occur. These relations are clearly shown in the sections presented herewith. We have not been able to definitely correlate the Chico Springs exposures with either of these levels, owing to facial changes in the character of the beds and the concealment of outcrops between the head of Chico Arroyo and the head of the west branch of Kimbetoh Arroyo where the lower horizon is well exposed, but the fauna indicates, with a fair degree of certainty, that this horizon is the lower level.

It may be of interest to note that the upper horizon is rich in fossils to the eastward and almost barren in its western extent, while the lower horizon is highly fossiliferous in its westerly outcrops and only sparingly so to the eastward. It seems probable that the larger part of Baldwin's Torrejon collection and nearly all of the Torrejon fossils obtained by the American Museum Expedition of 1892 came from the lower horizon, and to the westward of Escavada, while the collections of the expeditions of 1896 and 1912 were from the upper horizon of Escavada, Torrejon and intervening arroyos. Thus, while the whole Torrejon collection was about evenly divided between the upper and lower levels the existence of more than one level was not known, partly because fossils had not been obtained from both

levels in the same exposure and partly because the levels had not been carefully traced out from one exposure to another. The most important point of difference between the faunæ of the two levels, noted in a preliminary examination, is that the genus *Deltatherium* is confined to the lower horizon.

Thickness of the Torrejon.— This varies greatly from place to place, partly due to the fact that fossils have had to be used, so far, in locating the base of the Torrejon, and partly to an erosional unconformity at the top, beneath the basal Wasatch sandstone (Plate XXVII, Fig. 2). Still another difficulty arises from the lack of detailed contour maps which makes it impossible to correlate the various sandstones which overly unconformably the Torrejon clays. Some of these are Wasatch and some seem to be considerably younger. In the Ojo Alamo section, 113 feet 6 inches of beds between the level of three specimens of *Periptychus rhabdodon* and a heavy sandstone, resting unconformably on the clays, are referable to the Torrejon. The sandstone is not definitely determinable as Wasatch. Manifestly, the discovery of Torrejon fossils lower down than the *Periptychus* would change the position of the Puerco-Torrejon boundary as now drawn. In the Kimbetoh Arroyo section, a much greater thickness of the Torrejon is exposed. Here *Periptychus rhabdodon* was found 45 feet below the lower fossil level. Both of the reddish fossiliferous zones are represented. In addition to these, there is a considerable thickness of dove-colored, yellowish, dark slate-colored and other clays, with channel sandstones, between the upper fossil level and the Wasatch sandstone, which may be Torrejon or younger. They are well exposed at the head of Kimbetoh Arroyo and in adjacent portions of Blanco Cañon. To the southeast they are overlapped by the Wasatch sandstone. To the northwest, the slight easterly dip of the Paleocene formations and the overlapping of younger sandstones prevents their occurrence. Unfortunately, no fossils were found in them. Owing to a lack of the necessary facilities, the thickness of the Torrejon was not measured in this section. On the Arroyo Torrejon, Gardner's estimate of 140 feet is increased to 240 feet by the discovery of the lower fossil stratum referred to above, which also increases the Torrejon part of the Rio Puerco section from 281 to 660 feet. The unconformities which Dr. Gardner thought he could recognize do not exist, as they were founded on assumptions which the discovery of the lower fossil level of the Torrejon has shown to be untenable. The varying thickness of the Torrejon formation shown in the sections (Fig. 2) may be due to unconformable relationships with the Puerco, but this can neither be proved nor disproved by present evidence. It seems probable from the variation in position of the lower limit of the Torrejon, but as this has been determined by fossils, whose presence depends on the chance of preservation, exposure

and subsequent collection, the boundary cannot be regarded as fixed. It will probably be shifted by subsequent work.

Torrejon-Wasatch Relationships.— The Torrejon clays are overlain unconformably by heavy beds of gray conglomeratic sandstone which forms the rim-rock of the Torrejon and Escavada cliffs (Plate XXVII, Fig. 2) and probably represents a confluent alluvial fan deposit formed during a new depositional cycle in which coarse sediments succeeded clays and finer-grained sandstones. The erosion of the Torrejon clays previous to the deposition of this sandstone and its overlap beyond the edge of the Paleocene to the east and north accounts for the variation in level of the top of the Torrejon in the various sections and for its absence about the north and east margins of the San Juan Basin.

Origin of the Torrejon Sediments.— So far as the fossil layers are concerned, there does not seem to be any doubt of the aqueous origin of the deposit. All proofs cited in discussing the Puerco apply more or less to the Torrejon. There is less petrified wood present, but this is more than offset by the *Unio* beds which occur repeatedly in the type section, in gray clays of the upper fossil layer, often preserved as lenses of rotten shells seen on cross-section in the clay bluffs; at other times impressions of the *Unios* are found in masses of rusty calcareous concretion. Shells of land molluscs (*Pupa,* members of the *Helicidæ*) also occur in the clays affording mammal bones. On west Torrejon, small clay pellets, both round and angular, occur in a fine-grained clayey sandstone of the upper fossil layer forming the matrix of a partial skeleton, probably of *Pantolambda.* The abundant limy concretions may indicate aqueous deposition or they may be due to ground water circulating through the clay after deposition had taken place.

Age of the Puerco and Torrejon.

Both formations have for a long time been referred to as of Basal Eocene age. More recently, Paleocene seems to be growing in favor. Hitherto, we have not had data for working out satisfactorily evolutionary changes within the limits of each formation, owing to a lack of accurate information regarding levels. This is now available and will, doubtless, be of assistance in establishing more accurate correlations, but probably will not change materially our ideas of geologic age.

"Nacimiento" as a Group Name.

If no attention is to be paid to fossils, the "Nacimiento Group" proposed by Dr. Gardner to include the Puerco and Torrejon may be a convenient

term for map-making purposes. Its use might be further justified if there was no basis for the separation of the formations to which it applied, but this is very far from being the case. Although there is no marked difference in lithology between them and the presence of an unconformity has not been established, the difference in faunas is considerable, involving changes of not less than subgeneric value in the case of so-called genera common to the Puerco and Torrejon, with the introduction in the latter of many forms not known from either Puerco level. The rules of the United States Geological Survey for the discrimination of formations specify that "When two formations of closely similar lithologic character are in contact it will sometimes be necessary to depend almost entirely on the contained fossils in separating them."[1] This fully covers the case in point. The fixing of the boundary between the Puerco and the Torrejon is merely a matter of careful collecting and adequate mapping on a sufficiently large scale and with the proper detail. We fail to see the necessity for a group name.

Summary.

The more important stratigraphic results may be summarized as follows:—

1. Separation of the pre-Puerco beds into several members which are, in descending order, a heavy conglomeratic sandstone with much fossil wood, a series of clays with channel sandstones, a conglomerate and a series of dove-colored clays, red-banded near the top. The two conglomeratic members have disconformities at their bases. Dinosaurs occur, especially at two levels separated by the lower conglomerate. More or less of this series of beds may be correlateable with the Animas formation.

2. Complete confirmation of Barnum Brown's observation regarding the unconformable relationship of the Puerco with respect to the conglomeratic sandstone with fossil logs on which it rests. A topography in low relief was developed on the surface of this sandstone previous to the deposition of the Puerco clays, which cover up these hills and valleys.

3. Accurate location of the two Puerco fossil levels and demonstration of the fact that *Polymastodon* is confined to the uppermost of the two levels. For their position see sections A and B, Fig. 2.

4. Measurement of the thickness of the Puerco on continuous exposures from the unconformity at its base to the level of the first occurrence of Torrejon fossils.

5. Discovery of fossil plants in the Puerco.

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[1] U. S. G. S., 24th annual report, p. 23, part of rule 3.

6. Accumulation of data which seem to prove the fluviatile origin of the Puerco sediments.

7. Discovery of a new fossil horizon in the Torrejon, 100 feet below the horizon from which fossils had hitherto been obtained.

8. Finding of Torrejon fossils at still lower levels (see sections).

9. Location of the Torrejon levels with reference to those of the Puerco (see sections A and B, Fig. 2).

10. Correlation of the Rio Puerco and Arroyo Torrejon sections published by Dr. Gardner of the U. S. Geological Survey with the sections measured by the American Museum party.

11. Accumulation of data which seem to prove the fluviatile origin of the Torrejon sediments.

Collecting Localities.

For the convenience of subsequent workers, the principal collecting localities of the 1913 expedition are here listed. These are indicated on the map (Fig. 1) by numbers.

1. Two miles above Chico Springs. Torrejon, probably lower horizon. Two small exposures well up toward the head of Chico Arroyo. The larger exposures surrounding the store on Chico Arroyo proved barren. Small collection. Much concretion adhering to bones.

2. Two miles above Ojo Alamo. Lower and upper fossil horizons of the Puerco in great rincon of badlands on Ojo Alamo and Barrel Spring Arroyos and their branches. Principal exposures of *Polymastodon* horizon (upper fossil level of Puerco) found. Large collection from upper level. Skull of *Polymastodon.*

3. Three miles east of Ojo Alamo. Torrejon exposures at the head of Barrel Spring Arroyo. Three specimens of *Periptychus rhabdodon* found.

4. Five miles northwest of Ojo Alamo. Puerco exposures at the head of the west branch of Canon Gallego. *Polymastodon* horizon. Only two specimens found (both *Polymastodon* teeth).

5. First draw west of Kimbetoh Arroyo. Exposures on the west side of the draw. A short stretch of the lower Puerco fossil level at the base of the bluff. Small collection.

6. Old Dolan ranch, Kimbetoh Arroyo, four miles above Kimbetoh. Puerco exposures on both sides of the arroyo, but lower fossil level seen to advantage on east side. Skeleton of *Ectoconus* from beds in bluffs southeast of ruins of old ranch house.

7. Three miles east of Kimbetoh. Exposures of lower fossil level, Puerco, in branches of Kimbetoh Arroyo and in extensive badlands on nameless arroyo between Kimbetoh Arroyo and Escavada Wash, above where road to Cuba crosses. Very rich. Several good skulls.

8. Head of Kimbetoh Arroyo. Lower fossil level, Torrejon, exposed on both sides of the arroyo, well up toward the Blanco divide. Material all fragmentary, much of it concretion-covered, but in places abundant. Upper Torrejon horizon exposed, but barren.

9. Head of the west branch of Kimbetoh Arroyo. Lower fossil layer of Torrejon seen on the southwest face of the bluffs forming the Blanco divide. Abundant material; some partially complete skulls.

10. West branch Arroyo Torrejon. Both Torrejon horizons in face of cliff below Wasatch rim-rock. Good material from both horizons.

11. East branch Arroyo Torrejon. Same horizons as on west branch. Good material from both horizons.

12. Cliffs at head of Alamo Arroyo. Very limited exposures of upper Torrejon horizon.

13. Cliffs at head of Alamito Arroyo. Fairly rich exposures of upper Torrejon level. A small area of the lower level yielded one specimen.

14. Cliffs at the head of Escavada Wash. Both horizons of the Torrejon. Exposures extensive, but not very fossiliferous.

15. East and west branches of unnamed arroyo between Kimbetoh and Escavada. Upper Torrejon horizon extensively exposed but barren. Lower horizon of limited exposure and only very sparingly fossiliferous.

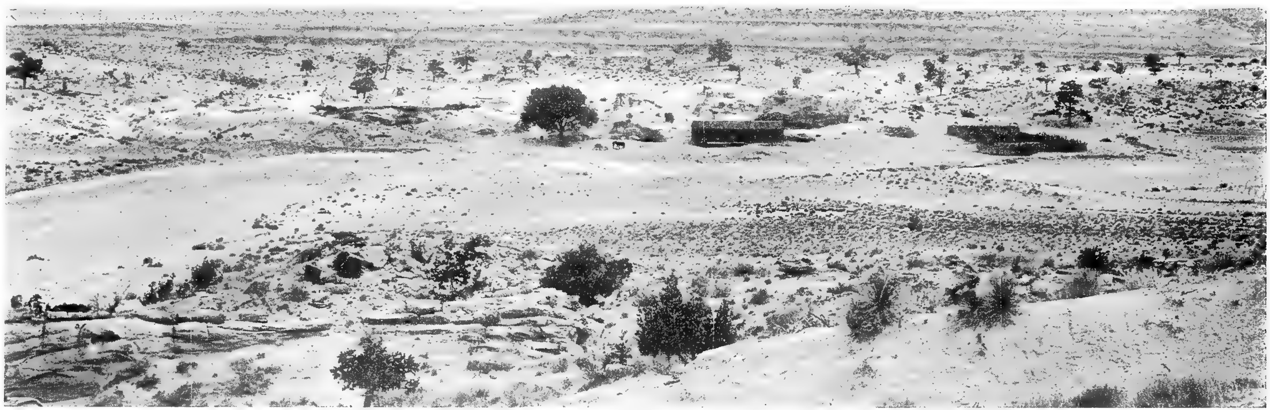
16. Cañon Blanco, a few miles above the Indian Mission. Upper Torrejon horizon exposed in several isolated areas and almost barren.

17. Head of an easterly tributary to the Torrejon Arroyo. Very limited exposures of the upper Torrejon horizon. A small collection obtained in 1912. This is the most easterly locality from which Torrejon mammals have been recorded.

18. Pina Veta China. A few miles north of the trading store. Basal Puerco and Ojo Alamo beds. No fossils obtained.

Fig. 1. Ojo Alamo beds looking north from Barrel Spring. The conglomeratic sandstone with fossil logs forms the castellated rocks on the ridge-crest. Upper horizon of dinosaur-bearing clays beneath the sandstone.

Fig. 2. Ojo Alamo beds a short distance below Barrel Spring. Conglomeratic sandstone with logs caps ridge to left. Upper dinosaur horizon just above junction of badland face and talus. Lower conglomerate at top of talus and strewing slope in foreground. Lower dinosaur horizon underlying talus and in bottom of arroyo at lower left-hand corner of picture.



Looking north toward Ojo Alamo. Puerco beds in distance. Conglomeratic sandstone with logs back of store and in foreground. Note large silicified log in lower left-hand corner.

Unconformable contact of the Puerco clays on the conglomeratic sandstone with fossil logs. Contact line accentuated by dotting. Silicified logs near cedars in foreground. Between Barrel Spring and Ojo Alamo Arroyos, looking north.

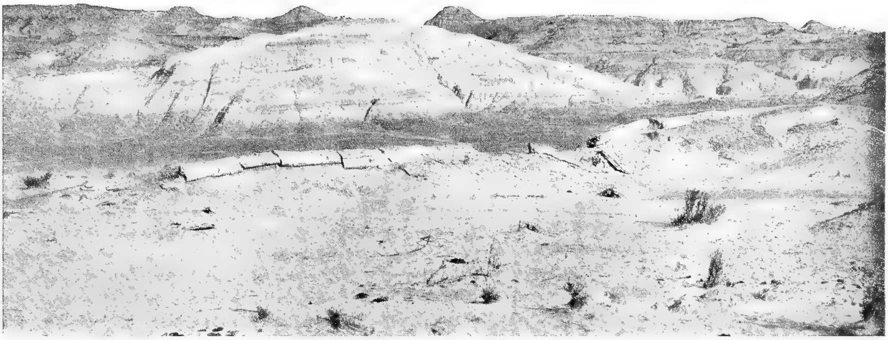


Fig. 1. Silicified log in clays below channel sandstone, Puerco beds in Barrel Spring Arroyo. The *Polymastodon* layer is about half way up the slope in the middle distance, to the right.

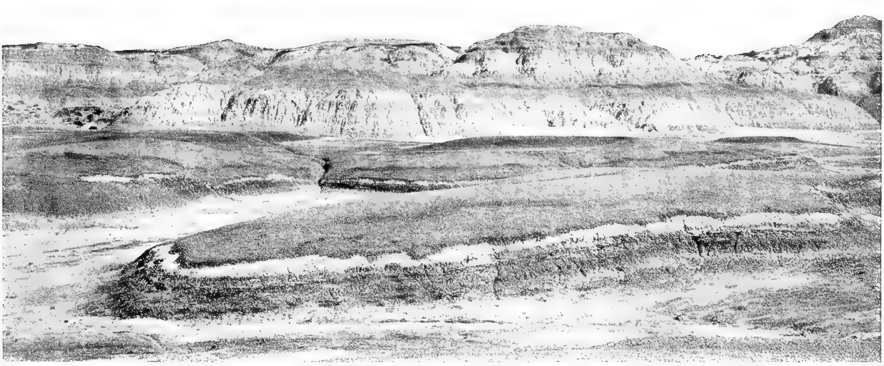


Fig. 2. Puerco exposures between Barrel Spring and Ojo Alamo Arroyos. Lignitic clays in foreground; red-banded clays of lower fossil level in middle distance. The white band below the lignitic clay is fibrous barite in small sheets and veins.

Locality in Puerco beds in Barrel Spring Arroyo where fossil leaves were found in concretionary manganese oxide. Position of leaf-deposits indicated by vertical arrow, on top of spur to right. Horizontal arrow points to upper fossil level of the Puerco (*Polymastodon* horizon).

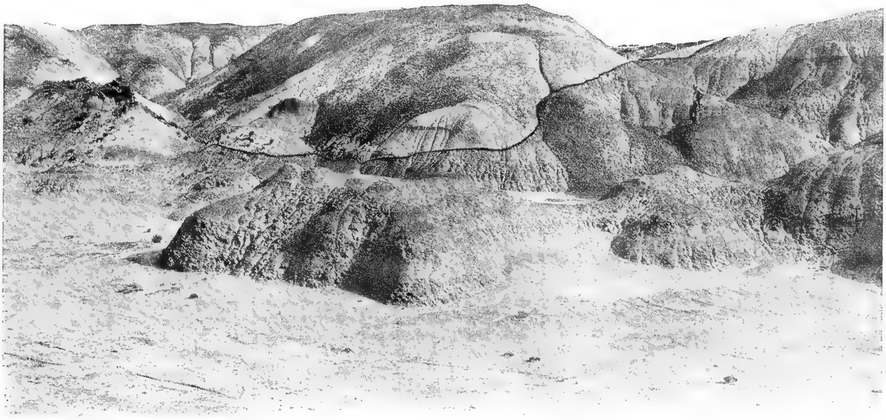


Fig. 1. Gray channel sandstone cutting out *Polymastodon* zone (upper fossil level of the Puerco) in Ojo Alamo Arroyo. Looking east. Contact accentuated.

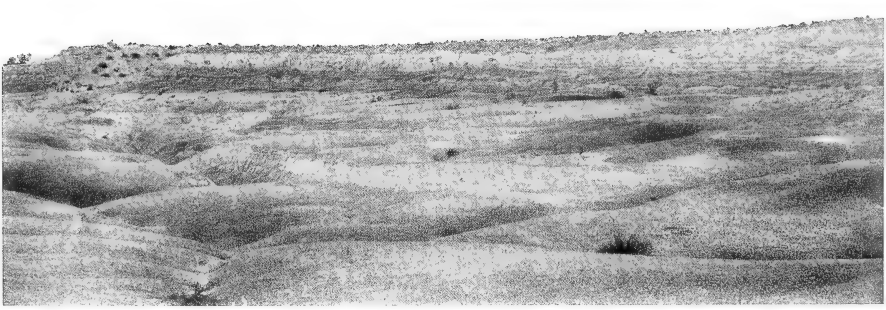


Fig. 2. Lower fossil level of the Puerco at base of cliff. Dark shale below fossil level capping bench in foreground. Exposure in nameless arroyo about 3 miles east of Kimbetoh station. Looking west. Same pocket as that shown in Pl. XXVI.

Puerco exposures in nameless arroyo about 3 miles east of Kimbetoh station. The beds dip slightly to the northeast. The lower fossil level appears on the surface of the flat and about the buttes in the foreground. It also surrounds the conical butte in the distance on the right. Looking southeast.

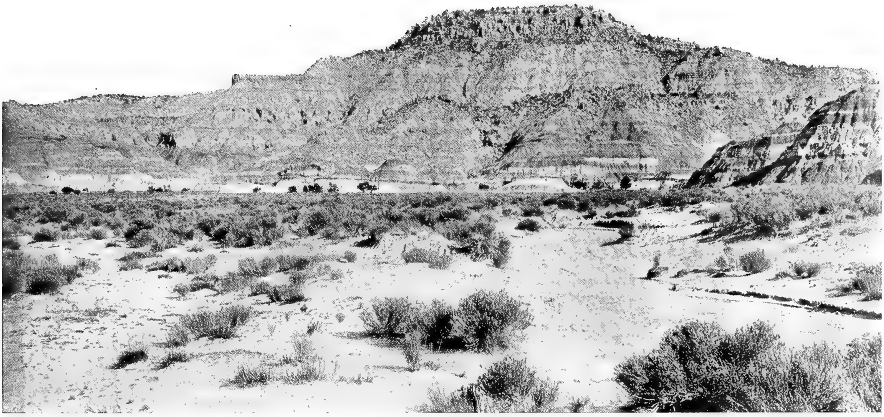


Fig. 1. Part of Cope's type section of the Puerco on the west side of Rio Puerco about four miles below Cuba. Wasatch sandstone caps cliff. A small amount of Puerco at the base; the rest Torrejon.

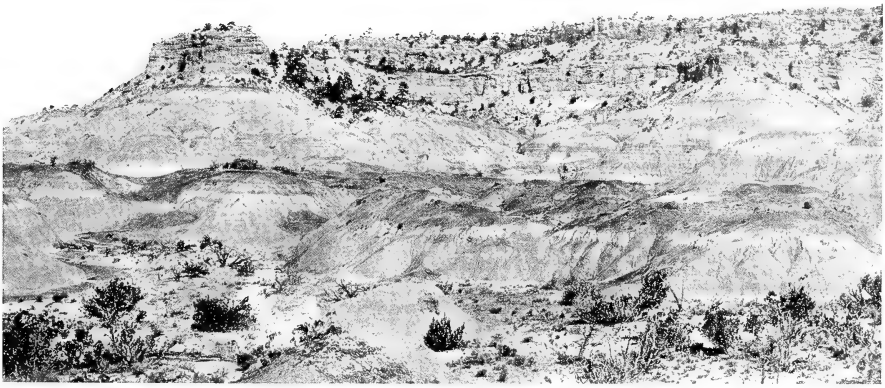


Fig. 2. Cliffs at head of west fork of Arroyo Torrejon. Cap rock is basal sandstone of the Wasatch. Concretion-covered slope in foreground marks position of upper fossil level of the Torrejon formation.

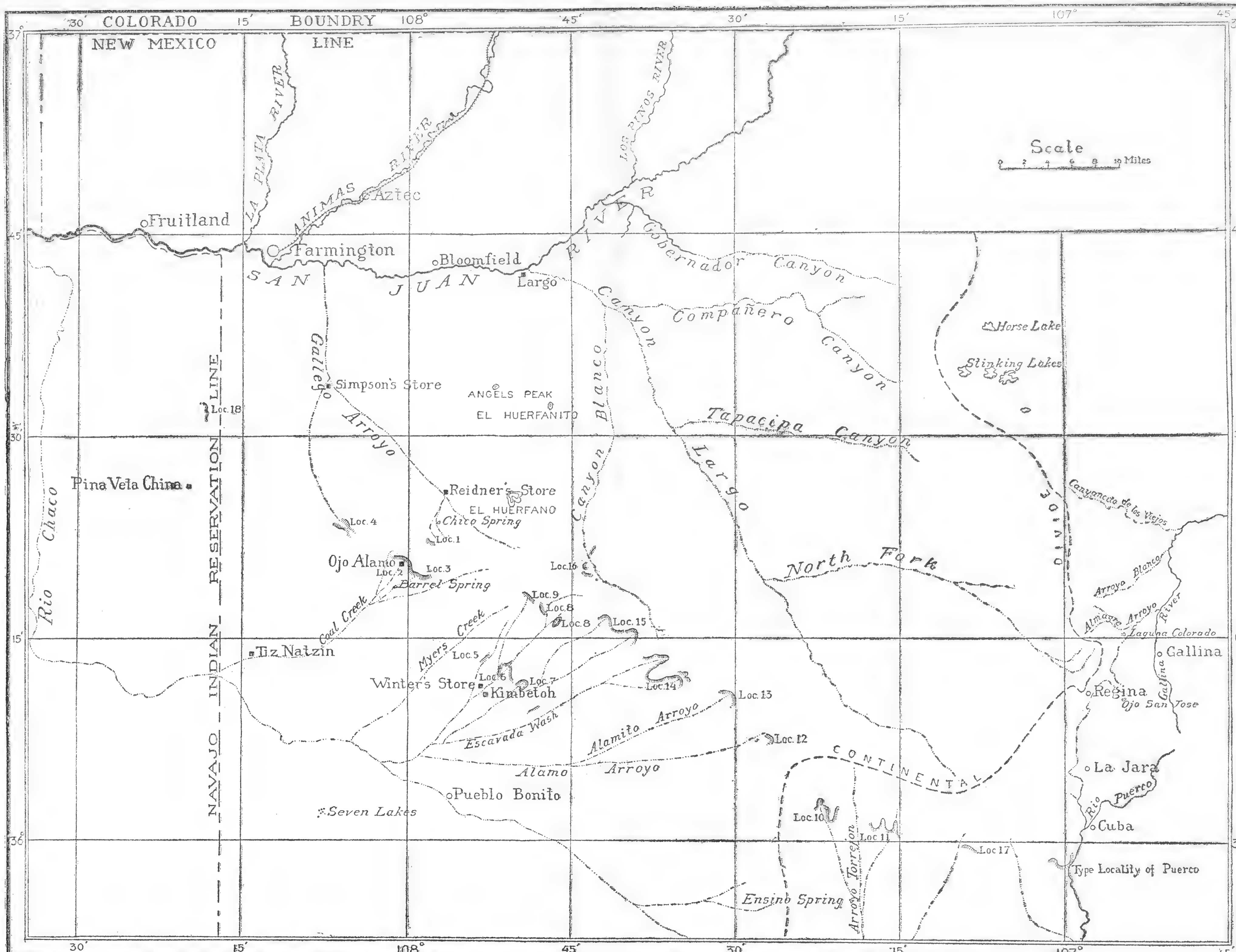
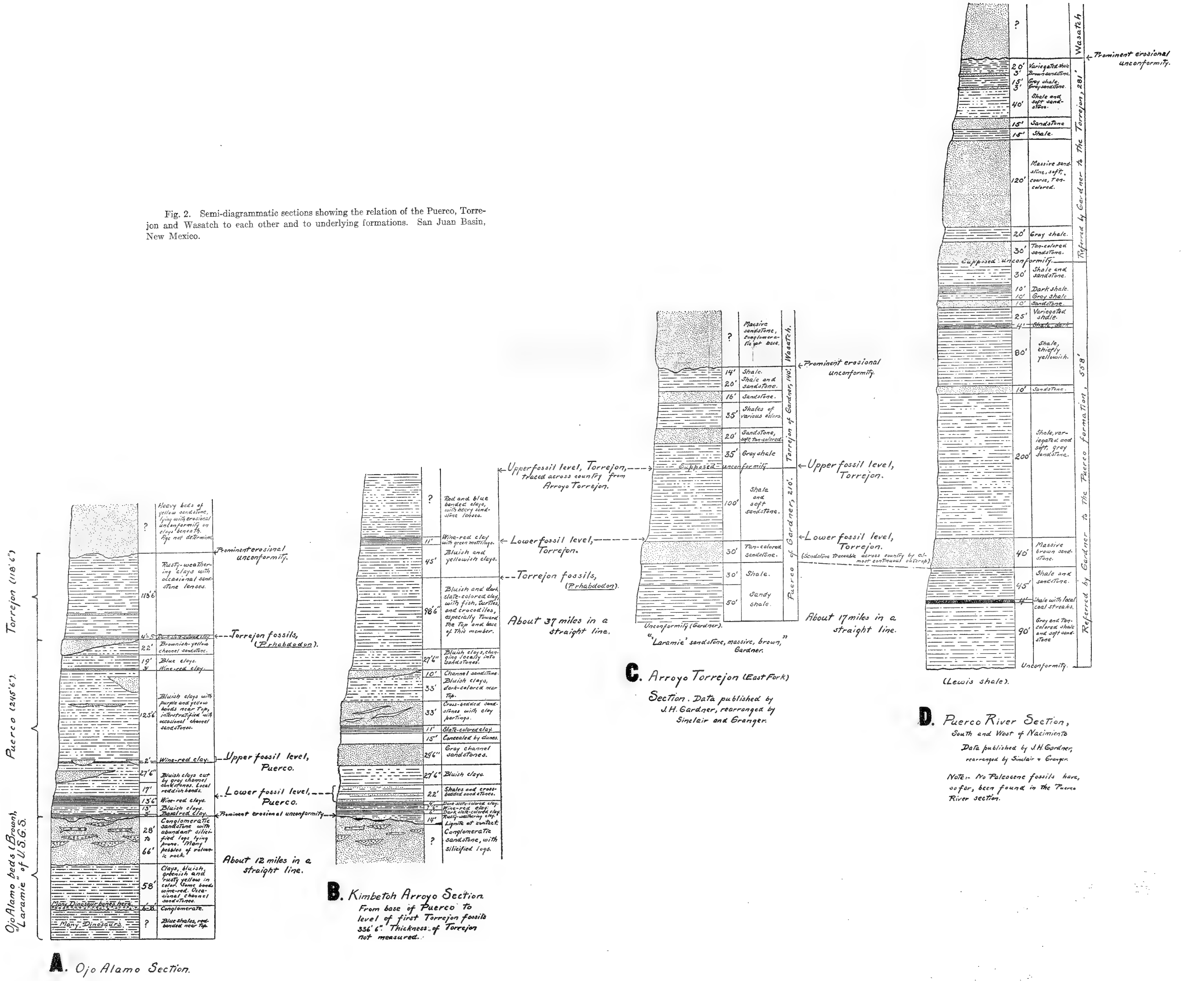


Fig. 1. Sketch Map of a portion of northwestern New Mexico, showing location of the more important Paleocene exposures. The numbers refer to the list of collecting localities at the end of this paper. Adapted from topographic maps of the U. S. Geological Survey.

Fig. 2. Semi-diagrammatic sections showing the relation of the Puerco, Torrejon and Wasatch to each other and to underlying formations. San Juan Basin, New Mexico.



59.82(86.6)

Article XXIII.— DESCRIPTIONS OF NEW BIRDS FROM ECUADOR.

By Frank M. Chapman.

In pursuit of its plans for a detailed ornithological survey of South America, the American Museum of Natural History has extended its work from Colombia into Ecuador where for some time Mr. William B. Richardson has been collecting in certain localities selected with a view to their bearing on problems in distribution. A detailed report on Mr. Richardson's large collections is not possible at this time, but a casual examination of them reveals several forms which appear to be unnamed and which are described herewith.

Leptotila ochraceiventris sp. nov.

Char. sp.— Not closely related to any described species of *Leptotila;* whole abdominal region rich ochraceous-buff as in *Geotrygon montana;* head without gray, the forehead pale pinkish buff; a clearly defined vinaceous breast-band.

Type.— No. 129338, Am. Mus. Nat. Hist., ♂ ad., Zaruma (alt. 6000 ft.), Prov. del Oro, Ecuador, Sept. 22, 1913; W. B. Richardson.

Description of Male.— Hind-head and nape deep brownish vinaceous approaching livid brown with slight purplish reflections, passing through pale brownish vinaceous anteriorly and becoming pale pinkish buff on the forehead and supraloral region; purplish reflections increasing in intensity posteriorly covering the foreback and spreading to the sides of the neck; remainder of the back and the upper tail-coverts olive-brown, the center of the back and, to a lesser extent, the upper tail-coverts with deep purplish reflections; central tail-feathers somewhat deeper olive-brown than the rump, the lateral rectrices slaty black, the three outer pairs tipped with a white tip which measures 16–18 mm. along the shaft of the outer feather and 5–7 mm. on the third feather; primaries externally fuscous or fuscous-black, the outer ones (except the short, sharply incised outer one) narrowly edged with pale cinnamon apically; inner quills and wing-coverts olive-brown, the latter with slight purplish reflections; inner webs of all the quills hazel or Mikado-brown, the under wing-coverts and axillars slightly deeper; chin and upper throat white surrounded by the pinkish or light pinkish cinnamon of the sides of the head and lower throat; breast light, purplish vinaceous, spreading to the purplish vinaceous of the sides of the neck and more or less sharply defined from the rich, uniform light ochraceous-buff of the abdomen and flanks; under tail-coverts white more or less tinted and margined with ochraceous buff; "legs pink, bill black, eyes yellow" (Richardson). Measurements of type: length (skin), 245; wing, 135; tail, 97; tarsus, 31; culmen, 17 mm.

Description of Female.— Resembles the male in color but averages slightly smaller. Wing, 134; tail, 95; tarsus, 31; culmen, 16 mm.

Description of Immature.— Immature birds of both sexes differ from adults in

having the vinaceous and purplish areas more or less tipped with buffy, the upper wing and tail-coverts and inner quills tipped with tawny, the white tips of the outer tail-feathers narrower; the wings and tail shorter. Wing, 126; tail, 90; tarsus, 31; culmen, 16 mm.

Remarks.— In addition to the six specimens from the type-locality we have an immature male from Daule near Guayaquil and an adult female from Chone, Manavi, in Western Ecuador. The species is obviously, therefore, not rare, and ranges from sea-level to at least 6000 ft., facts which increase our surprise that it should heretofore have eluded collectors. Only three species of *Leptotila*, however, seem to have been previously recorded from Ecuador, *L. verreauxi occidentalis, L. pallida*, and *L. rufaxilla*, all of which were obtained by Mr. Richardson. To none of these does the species here described bear close relationship; rather would it appear to be nearer to the group containing *L. rufinucha* and *L. cassini* species with which (except for a slightly longer tail) it agrees in size and resembles in the pattern of coloration of the upperparts, the hind-head and nape being more or less clearly defined from the forehead and mantle, while in the color of the remaining portions of the upperparts the three species are much alike, *ochraceiventris* being somewhat more olivaceous. Below, however, *ochraceiventris* is wholly unlike any other species of *Leptotila* known to me, and in coloration of these parts bears a singularly strong superficial resemblance to the adult male of *Geotrygon montana*. The color of the abdomen is essentially alike in both species, but in *montana* the vinaceous breast-band is broader and deeper, the chin buff instead of white.

Speotyto cunicularia punensis subsp. nov.

Char. subps.— Most nearly related to *S. c. nanodes* Berl. & Stolz., but much paler throughout, the whitish or buffy areas of the upperparts larger particularly on the hind-head and nape which appear to be streaked rather than spotted, the underparts much less barred, the throat bar greatly reduced.

Type.— No. 123970, Am. Mus. Nat. Hist., ♂, Puna Island, Ecuador, April 6, 1913, W. B. Richardson. Wing, 166; tail, 76; tarsus, 44; culmen, 19 mm.

Remarks.— Mr. Richardson collected seven specimens of this form on Puna Island from April 3 to 12, 1913. For comparison with them I have an equal number of skins of *S. c. nanodes* in the Brewster-Sanford collection taken by Beck at and near the type locality (Lima, Peru) in January, February, and April, 1913. The Puna Island birds are in somewhat more worn plumage than those taken in Peru in January and February, but a specimen of *nanodes* collected at Chorillos, April 11, is in wholly comparable plumage

and shows that the characters attributed to the Puna Island bird in the preceding diagnosis are racial, not seasonal. The differences in the underparts are especially marked, the barring being reduced to a minimum making, in connection with the extent of the whitish areas above, *punensis* the palest known form of its group.

Speotyto cunicularia juninensis, of which the Brewster-Sanford collection contains four specimens from Lake Junin, the type locality, is a much browner, more heavily barred bird which is even larger than true *cunicularia* from Chile. The Colombian form, *S. c. tolimæ* Stone, is described as being "darker than any of the other forms of *Speotyto*" and is doubtless as unlike *punensis* as the Upper Magdalena Valley it inhabits is unlike the arid portions of the coast of Ecuador.

While a number of birds have been described from Puna Island none of them, so far as I am aware, are confined to it and it is probable therefore that the Burrowing Owl recorded from Sta. Elena on the coast of Ecuador by Salvadori and Festa (Boll. Mus. Tor., No. 368, XV, 1900, p. 34) belongs to the form here described.

Pyrrhura albipectus sp. nov.

Char. sp.— Differing from any known species of *Pyrrhura* in having the throat and breast buffy white without or with but slight indication (in immature specimens only ?) of terminal bars, and in other characters.

Type.— No. 129379, Am. Mus. Nat. Hist., ♀, Zamora, alt. 3000 ft., Prov. Loja, Ecuador, Oct. 18, 1913, W. B. Richardson.

Description of Type.— Crown sepia the feathers with a paler terminal margin which increases in width and paleness and becomes nearly white on the nape; a faint indication of rose at the base of the bill; sides of the crown, from in front of eye to nape, yellowish green, region at the base of sides of the bill mixed yellow-green yellow and blackish; ear-coverts mixed scarlet-red and lemon-chrome; back and upper tail-coverts bright parrot-green, the latter with traces of bluish laterally; tail without indication of red, parrot-green above, blackish below, the outer feathers largely blackish, with a greenish tinge particularly on the outer web, the green increasing in extent inwardly and basally and occupying both webs of the central feather; outer primary black, the others Berlin blue with a greenish edge externally, the blue on the inner web increasing inwardly; secondaries largely parrot-green externally, blackish internally, all the quills blackish apically; bend of the wing and primary coverts scarlet-red, remaining coverts, above and below, parrot-green; throat and breast buffy white tipped faintly with lemon-yellow increasing in extent posteriorly, sides of the throat with a barely discernible indication of terminal grayish bars; rest of underparts yellowish parrot-green with bluish reflections, centre of the belly with a small amount of more or less concealed red; under tail-coverts bluish; feet blackish, bill horn, lower mandible whiter. Length (skin), 240; wing, 134; tail, 116; bill, 20 mm.

Remarks.— A second female, taken at the type-locality October 18, appears to be somewhat younger than the type, from which it differs in having the crown darker, the outer primary coverts green, the ear-coverts more orange, the sides of the throat, breast and underparts more distinctly barred with grayish, while, in certain lights, a suggestion of claret-brown appears in the darker areas of the rectrices.

A third specimen, from which unfortunately the label has become detached, agrees with the type in the practical absence of bars or terminal margins below but has the crown darker and with some traces of green, the cheeks green and the darker areas of the tail-feathers with an even stronger suggestion of claret-brown than in the second specimen mentioned.

This Parrot is apparently not closely related to any described species of *Pyrrhura.* It is possibly nearer *P. rupicola* than to any other member of the genus, but its differences from that species are too marked to require mention.

Tityra semifasciata esmeraldæ subsp. nov.

Tityra personata (not of Jard. & Selb.) Scl., P. Z. S., 1860, p. 295 (Esmeraldas).

Tityra semifasciata (not of Spix) Hart. Nov. Zool., V, 1898, p. 489 (Paramba, 3500 ft.)

Tityra semifasciata columbiana (part; not of Ridgw.) Helm., P. Z. S., 1911, 1142 (Esmeraldas in text).

Char. subsp.— Tail in the male with a broad subterminal black band which reaches the shaft of every feather and is of essentially equal extent on each; closely agreeing therefore in tail-pattern with *T. s. costaricensis* but with the terminal white band narrower, the subterminal band broader, the body plumage whiter and size smaller; female wholly unlike the female of *costaricensis,* and closely resembling in general coloration the female of *T. s. semifasciata* but with the black subterminal band much broader, the basal gray band correspondingly reduced, and dimensions much smaller.

Type.— No. 118803, Am. Mus. Nat. Hist., ♂ ad., Esmeraldas, Ecuador, Nov. 10, 1912, W. B. Richardson.

Remarks.— The exceptionally well marked characters of this race are supported by six adult specimens (four males and two females) from the type locality, a female from Barbacoas, Col., a male from Chone, Ecuador, and a single native skin received through Söderström labeled "San Miguel, 4000 ft." Of allied forms we have six males and five females of *costaricensis* from Panama, Chiriqui and Costa Rica; ten specimens of *T. s. personata,* an equal number of *T. s. griseiceps*; nine (including eight topotypes) of *T. s. columbiana,* and fourteen of *T. s. semifasciata* from the western borders of Amazonia.

With *personata* and *griseiceps,* in both of which the male is darker than in

costaricensis, no comparison is needed, but Hellmayr's (*l. c.*) reference of Esmeraldas specimens to *T. s. columbiana* should receive the attention always due the opinion of this authority on Neotropical birds. Fortunately our topotypical series of both forms is so adequate that examination of them permits one to reach satisfactory conclusions. Study of this material shows that *esmeraldæ* is a constantly smaller form in which the male has the upperparts, and particularly the nuchal region, whiter; the black area on the inner vane of the outer tail-feather always reaches the shaft and is never appreciably smaller than the corresponding area in the succeeding feathers, while in *columbiana* this area is either smaller on the outer than on the succeeding feather, or is separated from the shaft of the outer feather by a white line of varying width which connects the white tip with the white base of the feather. In short, so far as the tail pattern in the male is concerned, *esmeraldæ* differs from *columbiana* essentially as *costaricensis* differs from it, and the males of *esmeraldæ* and *costaricensis* more nearly resemble each other than either does that of *columbiana.*

When it comes to the females, however, the relationships of *esmeraldæ* are seen to be with true *semifasciata,* our three specimens being much grayer above than our four females of *columbiana* and quite as gray as the grayest of our females of *T. s. semifasciata.* The black tail-band, however, as has been mentioned in the preceding diagnosis, is wider in *esmeraldæ* than in *semifasciata.*

Measurements of Males.

		Wing	Tail	Bill
118803	Esmeraldas, Ecuador	117	67	24.5
118804	" "	117.5	67	26
118806	" " (Type)	117	67	25.5
118808	" "	118	70	25
71176	Santa Marta, Col.	121	72	24.5
72917	Valparaiso, Santa Marta, Col.	123.5	67	25.5
72918	" " " "	122	72	27
102262	Boruca, Costa Rica	123	73	26
123703	Atirro, " "	127	71	26.5

Measurements of Females.

118805	Esmeraldas, Ecuador	111	65	24.5
118807	" "	111	67	24
118048	Barbacoas, Col.	111	67	24
71177	Cacagualito, Santa Marta, Col.	118	67	26
72920	Minca, " " "	119	67	25
97865	Valparaiso " " "	119.5	66	24
77487	Chitra, Panama	117	70	25
106531	" "	118	65	25

Pitylus nigriceps sp. nov.

Char. sp.— Not closely related to any described species of *Pitylus* but most nearly resembling *P. fuliginosus* from which it differs in having the head as well as throat black, the outer tail-feathers tipped with white, and in other characters.

Type.— No. 130262, Am. Mus. Nat. Hist., ♂, Loja, alt. 7000 ft., Prov. Loja, Ecuador, Oct. 14, 1913, W. B. Richardson.

Description of Type.— Head, neck and throat all around black, the feathers of the centre of the throat with snowy white, but wholly concealed, bases; upperparts deep neutral gray with a faint olivaceous tinge which becomes more pronounced on rump; exposed superior surfaces of the tail like the back, concealed portions more fuscous, the two outer pairs of feathers with a white blotch at the end of the inner web; wings externally gray like the back, the concealed areas darker; breast gray like the back, becoming somewhat paler posteriorly; the belly warm-buff, lower tail-coverts ochraceous-buff, flanks gray washed with buff; feet blackish horn; bill (in skin) salmon-orange, tomiæ more yellowish. Length (skin), 220; wing, 103; tail, 99; tarsus, 29; culmen, 22; depth of bill at nostril, 15.5 mm.

Remarks.— A second unsexed (possibly female) specimen, collected at Loja, October 11, resembles the type, but the concealed white area which forms so interesting a character of that bird and reveals its relationships with *P. grossus*, is barely evident, the plumage is slightly more olivaceous, the bill somewhat longer, proportionately as well as actually less deep (culmen, 25; depth of bill at nostril, 15 mm.) and browner in color.

This species is obviously a member of the restricted genus *Pitylus* which contains also *P. grossus* and *P. fuliginosus.* The bill is less pronouncedly dentate than in *grossus* and more closely agrees in this respect with that of *fuliginosus* but is less laterally inflated than in that species.

In its buffy abdomen and white-tipped rectrices *nigriceps* suggests certain species of *Saltator* and indicates a possibly even closer relation between that genus and *Pitylus* than has heretofore been suspected.

The color terms employed in this paper will be found illustrated in Ridgway's 'Color Standards and Color Nomenclature' (Washington, 1912).

564,38(118: 78.7)

Article XXIV.— LAND SHELLS FROM THE TERTIARY OF WYOMING.

By T. D. A. Cockerell.

In 1912, Mr. W. Stein collected for the American Museum of Natural History a quantity of small land shells near the mouth of Pat O'Hara Creek, in Clark's Fork Basin, Wyoming. A study of this material reveals a surprising number of species, eight in all, and shows that shells apparently referable to the Indian genus *Boysia*, and to a new allied genus, inhabited the Rocky Mountain region in early Tertiary times. One of the new species collected by Mr. Stein was described in this Bulletin, XXXIII, p. 105; four others are described herewith.

It is extremely desirable that further material should be collected at Mr. Stein's locality, so rich in remarkable species, on the whole in an excellent state of preservation. It is surely probable that we have only a portion of a quite rich Molluscan fauna.

Protoboysia n. g. (Bulimulidæ.)

Shell conic-globulose, with an obtuse regularly rounded spire of seven flattened whorls; eighth whorl curved upwards, obliquely wrapping the spire, curving round it near the apex, the narrowly semilunar aperture situated on the sides of whorls 3 to 6; near the point where the last whorl ascends is a deep transverse constriction, the margins of which are thickened. The sculpture consists of fine oblique striæ, coarser on the last whorl. The nuclear region appears to be without sculpture. The umbilicus is represented by a chink. Type, *P. complicata* n. sp.

Protoboysia complicata n. sp. (Fig. 1; A, side view; B, from beneath.)

Length and width 3½ mm.; oblique striæ regular, about 6 in 160 μ near end of seventh whorl, fine and widely spaced (95–125 μ apart) a short distance before aperture.

Five miles southeast of mouth of Pat O'Hara Creek, Clark's Fork Basin, Wyoming. Above red-banded beds; probably base of Wasatch formation.[1] (*W. Stein*, 1912).

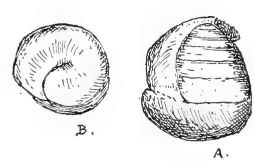


Fig. 1. *Protoboysia complicata.*

This is a most astonishing discovery; a shell entirely new to our American Tertiary, closely resembling the Indian *Boysia bensoni* Pfeiffer, but with the

[1] See, however, Granger, Bull. Amer. Mus. N. H., XXXIII, p. 204.

last whorl even more wrapped around the spire, and showing toward the base a swelling followed by a deep constriction. The last feature reminds us of the Brazilian *Tomigerus cumingi* Pfeiffer, which is perhaps the nearest relative of our shell in the New World. Pilsbry (Non-Marine Mollusca of Patagonia, Rep. Princeton Univ. Exp. to Patagonia, III, p. 619) has given maps showing the scattered distribution of this group of molluscs in the Neotropical Region; while we have the remarkable case of the genus *Hyperaulax,* which has a living species on the island of Fernando Noronha, and several fossil representatives in the Silex Beds at Tampa, Florida. The discovery of a member of this group in the Tertiary of Wyoming affords one more illustration of the former occurrence in the north of a type now more southern on both sides of the world.

Boysia *Pfeiffer,* 1849.

The two following species are without the callus and constriction at the beginning of the ascending whorl, and cannot at present be distinguished from *Boysia.*

Boysia sinclairi (*Cockerell*). (Fig. 2, showing broken aperture.)

Gastrodonta (?) *evanstonensis* var. *sinclairi* Cockerell, Bull. Amer. Mus. Nat. Hist., XXXI, (1912) p. 231.

The upturned whorl had been broken off in the type; but numerous specimens found with *Protoboysia* clearly show that the last whorl was directed upwards, very narrowly crescentic in section, to end on the fourth to sixth whorls in an aperture provided with a very thick reflexed lip. Only the upper end of the lip has been preserved, so the form of the aperture cannot be ascertained. The whole shell, except the apex, has delicate oblique riblets.

Fig. 2. *Boysia sinclairi.*

Boysia phenacodorum n. sp. (Fig. 3.)

Shell subglobose, about $5\frac{1}{2}$ mm. high and 7 broad; spire rounded and obtuse, with six very slightly convex whorls, which are distinctly obliquely striate, the sixth having coarse regular ribs, five to a mm.; the last, upturned whorl is only partly preserved, but appears to be formed as in *B. sinclairi,* except that it is not so narrowly crescentic in section. The umbilicus is closed.

Fig. 3. *Boysia phenacodorum.*

Two specimens, found with *Protoboysia*. Easily known from *B. sinclairi* by its smaller size and less elevated spire.

Vitrea sinoparum n. sp. (Fig. 4.)

Shell $5\frac{1}{4}$ mm. diameter, $2\frac{1}{4}$ high; spire low; whorls six, rounded, without distinct sculpture; aperture broad, somewhat oblique.

Found with *Protoboysia*.

Fig. 4. *Vitrea sinoparum.*

A very modern looking shell, without striking characters.

Thysanophora oxyænæ n. sp. (Fig. 5.)

Shell not quite 5 mm. broad, $2\frac{1}{4}$ high; spire low; whorls $5\frac{3}{4}$, rounded, the last whorl elevated next to the suture; aperture semilunar, comparatively narrow; umbilicus broad.

Found with *Protoboysia*. This is referred to *Thysanophora* with some confidence, on account of its resemblance to the living *T. ingersolli* of the Rocky Mountains; nevertheless, it might belong to the Zonitidæ, so far as the visible characters show. Seen from above, it looks like *Vitrea sinoparum*.

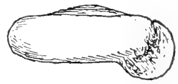


Fig. 5. *Thysanophora oxyænæ.*

Other shells found with *Protoboysia* are *Pyramidula ralstonensis* Ckll. (many) and *Oreohelix megarche* C. & H. (immature).

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Article XXV.— DESCRIPTIONS AND RECORDS OF COCCIDÆ.

I. Subfamily Diaspinæ.

By T. D. A. Cockerell and Elizabeth Robinson.

Odonaspis schizostachyi n. sp. (Figs. 1, 2.)

Female scale circular, little over 1 mm. diam., dull white, concentrically wrinkled, the large first skin very pale yellowish. The second pellicle encloses the adult; its pygidial margin shows two pairs of lobes, formed like those of *O. secretus*, but the median ones, which are large and more or less elbowed or lobulate at sides, are separated by a rather wide interval; the second lobes, remote from the first, are much smaller. The lateral margins of the second skin show long bristles, similar to those on the adult. Adult female round; pygidium terminating in a large median lobe which differs from that of *O. secretus* in being without lateral indentations; the second and third lobes are each bilobed, the third much lower than the second, and their lobules have entire margins; there are two spine-like plates laterad of the median and second lobes, and two, far apart, beyond the third; margin beyond third lobe finely crenulate. The base of the second lobe is prolonged caudad into a long finger-like process, and this is contiguous, on the outer side, with a striated band which terminates at the anal ring. The lateral margins have five principal indentations, marking sutures, and along the latter, pointing caudad, are single rows of minute quadrate scales with finely serrate apical margins, closely resembling the scales on a lepidopterous wing. Circumgenital glands in two groups, each of about 150, the groups uniform in width throughout their length, with the ends rounded. There is no line of glands connecting the two groups.

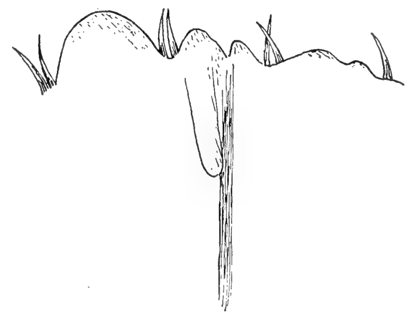

Fig. 1. *Odonaspis schizostachyi.* Caudal end of adult female.

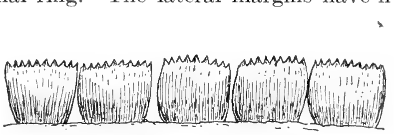

Fig. 2. *Odonaspis schizostachyi.* Scales on adult females.

Hab.— Los Baños, Philippine Is., Dec., 1913 (*C. F. Baker*).

Related to *O. secretus*, but readily separated by the entire median lobe, character of grouped glands, etc. Professor Baker thus describes the occurrence of this interesting species: "In the thickets of climbing bamboo

(*Schizostachyum*), which occur here everywhere, one of the most conspicuous objects is a purplish-black fungus which sheaths the stem, often for a length of two to three feet." This fungus has been described by Patouillard as *Septobasidium bakeri.* "Very little examination suffices to show that it is not at all parasitic on the bamboo, but that in every case it sheaths a colony of Coccids; and I have not observed the coccids without the *Septobasidium*!" The specimens of *Odonaspis schizostachyi* do not, however, show evidence of fungous parasitism; but, as must necessarily be the case, live and prosper under the dense black coating. When the fungus is removed, many of the scales adhere to its inner surface.

Hemichionaspis aspidistræ (*Signoret*). (Fig. 3.)

On leaves of *Smilax*, Los Baños, P. I. (*C. F. Baker*, 1751.) We present a figure of the pygidial margin of the second stage.

Fig. 3. *Hemichionaspis aspidistræ.* End of abdomen of second stage female.

Phenacaspis mischocarpi n. sp. (Figs. 4, 5.)

Female scale circular, about 1.75 mm. diameter, dull white, slightly transparent; exuviæ lateral, very pale orange, the first skin projecting beyond margin of scale; second skin broad-oval.

Female (after boiling in KHO) pale yellow, elongated, broadened anteriorly, conspicuously segmented; on each side of the mouth is a circular group of glands; pygidial area with three pairs of lobes; median lobes long, strongly divergent, serru-

Fig. 4. *Phenacaspis mischocarpi.* Caudal end of female.

late on inner margin, not produced beyond the level of the other lobes; second and third lobes each composed of two separate rounded lobules; a pointed glandular process laterad of each of the first and second lobes; long, spine-like plates (gland-spines) well developed, one laterad of each lobe, and three others on the margin beyond; margin beyond the lobes irregularly dentate, and with four incisions with thickened edges. Circumgenital glands with median group of 8–9 orifices, the lateral groups each of 16–17 orifices, the anterior and posterior lateral groups contiguous, almost confluent. Male scale about 1 mm. long, distinctly tricarinate; exuvia pale yellow.

Fig. 5. *Phenacaspis mischocarpi.* Side of abdomen of adult female.

Hab.— Los Baños, Philippine Is., Dec. 1913, on *Mischocarpus fuscescens* Blume (*C. F. Baker*, 2179).

According to the Index Kewensis, *Mischocarpus* Blume (Sapindaceæ) is the same as *Ratonia* D. C., but *M. fuscescens* is *Cupania helferi* Hiern.

P. mischocarpi resembles *P. strobilanthi* (Green) in the long serrated median lobes, but differs conspicuously in the form of the ♀ scale, and in the margin beyond the lobes, which is *strobilanthi* is coarsely serrate and finely serrulate. In the form of the scale the new species greatly resembles *P. latissimus* (Ckll.), but in that species the margin beyond the lobes is coarsely crenate, instead of being sharply toothed, while the male scale has only a very feeble median keel. *P. flava* (Green) has the region beyond the lobes crenate as in *latissimus,* and the scale is quite different from that of *P. mischocarpi.* *P. varicosa* (Green) has the margin beyond the lobes formed as in *strobilanthi;* while *P. dilatata* (Green) has shorter median lobes, not so close together at the base, and lacks well-defined third lobes. The other species of *Phenacaspis* are even more distinct.

Hemichionaspis minor (*Maskell*).

Swan Island; on fruit of *Anona muricata;* sent by Mr. Samuel Henshaw. No collector's name is given, but it was probably obtained by Mr. Geo. Nelson.

Targionia gutierreziæ (*Cockerell & Parrott*).

On *Artemisia tridentata,* Steamboat Springs, Colorado (*E. Bethel*).

Pinnaspis buxi (*Bouché*).

Los Baños, Philippine Is., abundant on leaves of *Aglaonema philippinensis,* Jan. 1, 1914 (*C. F. Baker* 2182). Grouped glands; median 4, cephalolaterals 9, caudolaterals 8.

Pinnaspis rhombica Leonardi, from Java, is a *Hemichionaspis; Pinnaspis javanica* Leonardi, also from Java, is a *Fiorinia.*

Hemichionaspis uvariæ n. sp. (Fig. 6.)

Female scale rich red-brown, about $1\frac{1}{2}$ mm. long, very narrow, almost linear; exuviæ paler and yellower; second skin about 560 μ long.

Female greatly elongated, about 880 μ long and 250 wide, the sides not prominently lobed; yellowish, turning greenish in KHO, the eyes large and heavily pigmented. Base of mouth parts only 80 μ from anterior end. Grouped glands in five groups, caudolaterals and cephalolaterals 8 each, median 4, the laterals variable, but never as many as ten; genital orifice caudad of anal orifice, the latter 68 μ from bases of median lobes; median lobes large, dark, together forming a semicircle, their margins crenate or dentate, with six small teeth, the outer two very minute; second lobes represented by two small lobules, the first rounded, the second pointed, and beyond this a rudimentary prominence behind the spine; immediately laterad of the spine is a very large spine-like plate, after which the margin is abruptly directed cephalad, and is divided into two or three flattened lobules, immediately beyond which is a large spine-like plate.

Fig. 6. *Hemichionaspis uvariæ.* Caudal end of female.

Eggs large, about 175 μ long.

Male scale hardly over half a mm. long, white, parallel-sided, with an obtuse median keel, and no distinct lateral ones; larval skin pale orange fulvous.

Hab.— Los Baños, Philippine Is., in quantity on under side of leaves of *Uvaria* sp. (Anonaceæ); collected by Prof. C. F. Baker (738).

In the rather sharp teeth of the median lobes this resembles *H. scrobicularum* or *H. rhododendri,* but the apical crenation is narrower than in these species, and the margin beyond the lobes is different. In Cooley's table (1899) it runs to *H. mussændæ,* which has very much more numerous grouped glands, and differs in other particulars. In Green's table (1899) it goes to *mussændæ* and *rhododenderi,* but is quite distinct from both. It is not closely allied to *H. rhombica* (*Pinnaspis rhombica* Leon.).

II. Non-Diaspine Subfamilies.

By T. D. A. Cockerell.

Lecaniodiaspis rufescens (*Cockerell*).

Ceroplastes irregularis *Cockerell.*

These two species were collected by Mr. E. Bethel at Cañon City, Colorado, on *Atriplex canescens.* He writes that they "completely cover" the plants at a locality where honey ants abound, and suggests that they probably furnish part of the food of the ants. *L. rufescens* was also collected on *Fraxinus anomala* at White Water, Colorado, 1908, by Prof. C. P. Gillette.

Tachardia fulgens *Cockerell.*

Hills near Huasihuas, Sonora, March 25, on leguminous bush, 3 to 6 feet high, with yellow flowers (*C. H. T. Townsend*).

Ceroplastes gigas n. sp. (Fig. 7.)

Scale on branch of tree; wax white and smooth. Scale $17\frac{1}{2}$ mm. long, $14\frac{1}{2}$ broad, about 12 high; wax not divided into plates; a deep median dorsal pit; at sides are two angular projections clasping the branch. Wax about 5 mm. thick. Female oval, about 7 mm. long, chestnut red; antennæ and legs light ferruginous. Antennæ long and slender, second joint 75 μ long, third about 50. Cephalic margin of female broadly rounded, caudal margin trilobed.

Hab.— Philippine Islands, presumably near Los Baños, sent without any information by Prof. C. F. Baker.

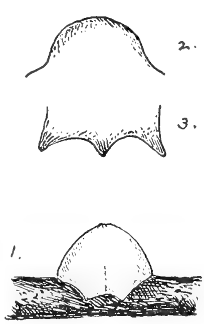

Fig. 7. *Ceroplastes gigas.* 1. Scale on branch. 2. Cephalic margin of female. 3. Caudal margin of female.

There is only a single scale, but it is such a remarkable form that it is safe to describe it. I removed it from the branch, and was able to make out some of the structural characters, and then replaced it.

The species closely resembles *C. vuilleti* Marchal, but the margin of the female is differently formed, and the antennæ of *vuilleti* have joints 2 and 3 equal. *C. vuilleti* occurs in western Africa.

Lecanium perinflatum n. sp. (Fig. 8.)

Female scale globular, 9 mm. long, $8\frac{1}{2}$ broad, 8 high; dull orange (nearly apricot color), with sparse small round red spots, mostly with a black central dot; surface smooth and moderately shining, except for a fine pustulation, not visible without a lens. The scale clasps the twig below, with a thick reddened margin. Under the compound microscope the red spots exhibit no radial pattern, nor are they sharply defined; their diameter is about 240 to 400 μ. Posterior incision short (about 2 mm.); at its upper end the very small triangular anal plates visible, about 192 μ long. The submarginal area of the scale is strongly pitted.

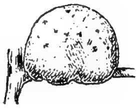

Fig. 8. *Lecanium perinflatum.*

A young scale, about 3 mm. long, is oval, convex, shaped like an ordinary *Eulecanium*, with small dusky spots, not very conspicuous. The marginal region is darkened and rugose.

Hab.— On small twig of some herbaceous (shrubby?) plant with entire leaves, the twigs distinctly angular in section; Santa Ana, Misiones, Argentine Republic (*Lahille*, 10.)

Related to *L. verrucosum* Signoret from Montevideo, but much smaller, and less densely spotted. I have had this species for many years, awaiting material for dissection, but obtaining none, I at length describe it.

L. perinflatum and *L. verrucosum* cannot be referred to *Akermes;* they do not agree well with any described genus, and are referred to *Lecanium* in the broad sense.

Protopulvinaria longivalvata bakeri n. sp. (Fig. 9.)

Female scale $2\frac{1}{4}$–$2\frac{1}{3}$ mm. long, $1\frac{3}{4}$ broad, light ferruginous; shape, appearance and markings as in typical *longivalvata* (cotypes compared); marginal spines few, rather

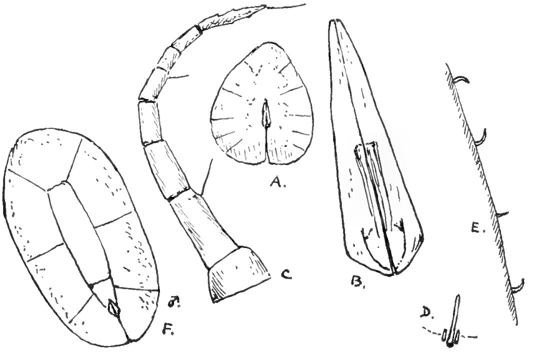

Fig. 9. *Protopulvinaria longivalvata bakeri.* A. Female scale. B. Anal plates of female. C. Antenna of female. D. Stigmatic spines of female. E. Marginal spines of female. F. Scale of male.

stout, bent, very small and short, about 3 μ long; stigmatic spines in threes, one long (about 22 μ), the others very short; mouth-parts small, 103 μ wide; anal plates greatly elongated, near middle of scale; each plate 375 μ long, 65 μ wide, the length varying in different individuals from 272 to 432 μ; distance from tips of anal plates to hind margin (opening of anal cleft) about 750 μ; legs ordinary, claws strongly hooked at end; antennæ eight jointed. The following measurements are in microns:

	Femur + trochanter.	Tibia.	Tarsus (excl. claw).
Anterior legs	130	80	45
Middle legs	133	80	50

Two antennæ measured, the joints enumerated in order from first to eighth.

28.	48.	33.	28.	23.	18.	23.	48.
25.	50.	35.	25.	28.	20.	23.	53.

There is hardly any cottony secretion.

Hab.— Los Baños, Philippine Is., Jan. 25, 1913, on the lanceolate-ovate entire leaves of "bocanga." (*C. F. Baker*, 976.)

Typical *P. longivalvata,* from Ceylon, has the third antennal joint longest, the anal plates longer (length 480-592 μ), and the marginal spines longer (length about 5–7 μ). The marginal spines are rarely somewhat bifid at end in *longivalvata,* but in my material they do not appear to be distinctly fimbriate.

I suppose that *P. bakeri* is endemic in the Philippine Is., and should properly be regarded as a distinct species, but it is so close to the Ceylon insect that for the present I give it only subspecific rank. The glassy male scale was found, and has been figured; it presents no remarkable features. The plant, "bocanga," is not given in Merrill's list of Philippine plant names.

Paralecanium luzonicum n. sp.

Female scale very broad oval, 4½ mm. long, red brown; marginal zone ill-defined, but apparently occupying nearly ¾ the distance between tips of anal plates and hind end; dorsal surface thrown into folds and reticulations, as in several of the Ceylon species; ends of anal plates very sharp, the apicolateral sides of plates longer than the basolateral; stigmatic spines in threes, very stout, blunt, the margin of the stigmatic notch much thickened; legs well developed, tarsus longer than tibia; the following measurements are in microns: anterior leg, femur with trochanter, 130, tibia, 68, tarsus 75; middle leg, tibia 73, tarsus 105; another middle leg, tibia 68, tarsus (without claw in each case) 95; claw digitules stout; antennæ apparently 7-jointed, but joints 4 to 6 are more or less fused, so that they cannot be clearly differentiated; measurements of joints in microns (1.) 23–25, (2.) 23, (3.) 63–70, (4.) 30, (5.) 25, (6.) 30, (7.) 33–38. The marginal plates are transversely broad-oval, overlapping, about 38 μ long and 30 broad, their margins entire.

Hab.— On leaves of *Alectronia viridis*, Los Baños, Philippine Is., Feb. 15, 1913 (*C. F. Baker* 1161).

By the structure of the marginal area this would fall with *P. marginatum* (Green), which is however much smaller, and differs in details of structure. It also resembles *P. peradeniyense* (Green), differing by the broader form, the much more sharply pointed anal plates, and the different legs and antennæ.

P. cocophyllæ Banks, described from the Philippine Is., has much more degenerate antennæ, and no legs at all.

Tachardia gemmifera *Cockerell.*

Dr. M. Grabham sends specimens from Kingston, Jamaica, and writes: "I visited Mr. Vendryes's garden some years ago and found the *Tachardia gemmifera* in abundance on the *Chrysobalanus.* The garden and trees have been destroyed since, but I have found the same creature in several other gardens." It is remarkable that this striking species, described in 1893, has never been found anywhere but at Kingston.

Llaveia luzonica n. sp.

♂. Length about 6 mm., not counting caudal tassels; wings about $6\frac{1}{3}$ mm.; antennæ reddish-black; head mostly yellowish flesh-color, dark about bases of antennæ, and occipital margin dusky; thorax pale carneous, the dorsal region shining black, but the scutellum very pale yellowish-carneous, abruptly contrasting with the black mesothorax; abdomen very broad, pink with eight long hairy plumbeous tails, their length however not equal to the diameter of the abdomen; legs dark castaneous; wings ample, black, with the usual venation and two light lines. At the sides of the thorax anteriorly, from the occipital region to a short distance before the wings, are very large rounded upwardly directed lobes or lappets. In the middle of the antennæ are three nodules to a joint, each bearing a whorl of very long black bristles.

Hab.— Mt. Makiling, Luzon, Philippine Is., (*C. F. Baker*, 1615). A cotype, a little smaller than the type, is from Los Baños, P. I. (*Baker*, 1081).

Close to *Llaveia dalbergiæ* (*Monophlebus dalbergiæ* Green), but considerably smaller. On comparison with Green's figures of *dalbergiæ,* our species appears to differ by the long and narrow halteres, which are shaped like a spear-head with a blunt apex, the broadest part below the middle; also, the four apical caudal tassels are considerably shorter.

Our insect is larger than Green's *Monophlebus stebbingi* var. *octocaudata.* The penis is much shorter than in *L. saundersii,* but as in that species, is thickened apically.

The generic arrangement of the monophlebines is still unsettled, but it appears certain that *Monophlebus* must be restricted to forms with two caudal

tassels in the male, such as *M. pallidus* Newst., which is so admirably figured in the Report of the Swedish Expedition to Kilimandjaro (1908).

Eriococcus borealis *Cockerell.*

On *Artemisia tridentata,* mixed with *Targionia gutierreziæ,* Steamboat Springs, Colo. (*E. Bethel*). The creamy-white ovisacs are 2 to 3 mm. long. The antennæ of the larva have joints 2 to 6 measuring in μ: (2.) 18, (3.) 28, (4.) 13, (5.) 15, (6.) 23. Thus the antennæ of the larva quite closely resemble those of adult *E. neglectus* Ckll.

Icerya purchasi crawii *Cockerell.*

Dr. E. P. Van Duzee sends numerous specimens, with the following data: "From an *Acacia* or "wattle" tree growing at Alpine, 30 miles east of La Jolla, California, at an altitude of 1800 feet. The tree was nearly killed by the freeze of a year ago, and now these insects are likely to finish the work."

59.9(67.6)

Article XXVI.— MAMMALS FROM BRITISH EAST AFRICA, COLLECTED ON THE THIRD AFRICAN EXPEDITION OF THE AMERICAN MUSEUM BY WILLIAM S. RAINSFORD.

By J. A. Allen.

The third African Expedition left New York in July, 1912, under the direction of William S. Rainsford,[1] with Jenness Richardson as preparator, and returned in April, 1913, with a collection of about 130 mammals and a few birds. The mammals consist mainly of large game animals, carnivores, and monkeys but include also about 60 small mammals, chiefly rodents, 40 species in all being represented. The specimens are exceptionally well prepared and reached the Museum in excellent condition. The smaller species (rodents) are represented by skins and skulls, the larger species by skins and complete skeletons. All have full field data and measurements taken from the animals in the flesh.

The smaller species have all been determined by direct comparison with the British East Africa material in the United States National Museum, collected on the Roosevelt, Rainey, and other expeditions and identified by Edmund Heller, to whom I am indebted for valued assistance. No new forms appear to be represented, the material having been gathered in or near localities that have been well explored by British, German and American collectors during the last ten years, but in a few instances the positively known range of currently recognized forms has been extended. Besides securing important desiderata for mounting, several species still rare in collections were obtained, among them a fine series of *Bdeogale jacksoni*, *Dendrohyrax bettoni*, *Genetta bettoni*, and *Erythrocebus whitei*.

Mr. Rainsford in his account of the expedition (*l. c.*) states: "After much study of the question, the Nzoia Plateau, especially the Cheringani Hills at its eastern part, was chosen as the hunting ground, a small area about one hundred miles by seventy in extent, and some one hundred and fifty miles from the railroad. . . .This country has forests unusual for East Africa. The altitude ranges from a little over 4000 feet above sea level in some of the lower parts to 10,500 feet, where dense woodlands cover the summits of the hills. Impassable ravines and deep swamp-edged narrow streams were met with everywhere and made necessary considerable digging and rough bridging and road-making."

[1] For a general account of the expedition see 'Trackers of the Cheringani Hills,' by W. S. Rainsford. The American Museum Journal, Vol. XIII, No. 7, pp. 299–310, Nov., 1913.

1. **Syncerus caffer radcliffei** (*Thomas*). EAST AFRICAN BUFFALO.

Three specimens, adult male and female and young female, Cheringani Hills (9000 ft.), Nov. 14.

Collector's measurements: total length, ♂ 3304 mm., ♀ 2593; tail vertebræ, ♂ 636, ♀ 623.

2. **Taurotragus oryx pattersonianus** *Lydekker*. EAST AFRICAN ELAND.

Five specimens, 1 adult and 1 yearling male, 1 adult and 2 young females, Uasin Gishu Plateau (7000–7200 ft.), Oct. 18–25.

Collector's measurements: Total length, ♂ 3050, ♀ 2923; tail vertebræ, ♂ 560, ♀ 540.

3. **Tragelaphus scriptus delemerei** *Pocock*. HIGHLAND BUSHBUCK.

Four specimens, 2 males (one half grown), 2 females, Cheringani Hills (6600–8000 ft.), Nov. 18 and Dec. 3.

Collector's measurements: total length, ♂ 1551, ♀ ♀ 1398, 1246; tail vertebræ, ♂ 212, ♀ ♀ 233, 23[illegible]

4. **Redunca redunca wardi** (*Thomas*). HIGHLAND REEDBUCK.

Six specimens, 3 males (including 1 in first pelage), 3 females, Uasin Gishu Plateau (6000–7000 ft.), Dec. 3–25.

Collector's measurements: total length, ♂ ad. 1565, ♀ ♀ ad. 1422, 1334; tail vertebræ, ♂ 165, ♀ ♀ 153, 146.

5. **Oreodorcas fulvorufula chanleri** (*Rothschild*). CHANLER'S REEDBUCK.

One specimen, adult female, Cheringani Hills (7000 ft.), Nov. 30.

Also 2 specimens have been received from the Laikipia Escarpment, collected by A. J. Klein, March 21, 1912.

6. **Ourebia montana cottoni** (*Thomas*). UASIN GISHU ORIBI.

Four specimens: Uasin Gishu Plateau (7000 ft.), 1 young female, Dec. 20; Cheringani Hills (6300–7000 ft.), 2 males and 1 female, Dec. 1 and 2.

Collector's measurements: total length, ♂ ad. 1041, ♀ ad. 1004; tail vertebræ, 70, 76.

7. **Sylvicapra grimmia nyansæ** *Neumann.* UGANDA BUSH DUIKER.

Two specimens, females, Uasin Gishu Plateau (6500–7000 ft.), Oct. 29 and Feb. 1.

Collector's measurements: total length, 875; tail vertebræ, 90. (One specimen without measurements.)

8. **Cephalophus monticola musculoides** *Heller.* NANDI BLUE DUIKER.

Two specimens, adult male and female, Elgeyo Forest (6000 ft.), Jan. 23.

Collector's measurements: total length, ♂ 711, ♀ 711; tail vertebræ, ♂ 80, ♀ 82; ear, ♂ 58, ♀ 54.

9. **Damaliscus korrigum jemala** (*Matschie*). TOPI.

Two specimens, male and female, Uasin Gishu Plateau (7000 ft.), Oct. 24 and Dec. 20.

Collector's measurements: total length, ♂ 2135, ♀ 1893; tail vertebræ, 445, 343.

10. **Raphicerus campestris neumanni** (*Matschie*). MASAILAND STEINBOK.

One specimen, adult male, Uasin Gishu Plateau (7000 ft.), Oct. 22.

Collector's measurements: total length, 768; tail vertebræ, 314.

11. **Bubalis lelwel jacksoni** *Thomas.* JACKSON'S HARTEBEEST.

Five specimens, 3 males, 1 female and a young calf, Uasin Gishu Plateau (5700–7000 ft.), Oct. 17–22 and Dec. 22.

Collector's measurements, 3 males, 1 female: total length, ♂♂ 1930, 2120, 2260, ♀ 2210; tail vertebræ, ♂♂, 343, 387, 432; ♀ 432.

12. **Potamochœrus koiropotamus dæmonis** *Major.* EAST AFRICAN BUSH PIG.

Two specimens, an adult male and a young male in striped coat. Cheringangi Hills, Nov. 6.

Collector's measurements: total length, ♂ ad. 1587; tail vertebræ, 395.

13. **Diceros bicornis somaliensis** *Potocki.* Somali Black Rhinoceros.

Four specimens, 1 male, 2 females and 1 young female, Cheringangi Hills (6000–7000 ft.), Nov. 4–Dec. 8.

Collector's measurements: total length, ♂ 3560, ♀♀ 3305, 3355; tail vertebræ, ♂ 660; ♀♀ 497, 560.

14. **Dendrohyrax bettoni** *Thomas & Schwann.*

Five specimens, 3 females (2 fully adult) and 2 young about one quarter grown, Uasin Gishu Plateau, Dec. 23. The two young specimens are still in the soft, woolly first pelage, but closely resemble the adults in coloration.

Collector's measurements: 3 females, total length, 457, 464, 495; tail vertebræ, 32, 36, 38; hind foot, 61, 66, 67. Skull: condylobasal length, 80, 89, 89; zygomatic breadth, 43, 46, 46.3.

15. **Tachyoryctes splendens badius** *Thomas.*

Two specimens: Uasin Gishu Plateau (7800 ft.), 1, Oct. 11; Elgeyo Forest (6000 ft.), 1, Jan. 15.

16. **Arvicanthus nairobæ** *Allen.*

One specimen (juv.), Cheringangi Hills (6400 ft.), Nov. 2.

17. **Lemniscomys pumilio dimidiatus** (*Thomas*).

Four specimens: Elgeyo Forest, 3, Jan. 19; Uasin Gishu Plateau, 1, Oct. 8.

18. **Lemniscomys massaicus** (*Pagenstecker*).

Two specimens: Elgeyo Forest, Jan. 29; Uasin Gishu Plateau, Oct. 8.

19. **Lophuromys aquilus zena** *Dollman.*

Three specimens: Elgeyo Forest (6000 ft.), 2, Jan. 17, 24; Uasin Gishu Plateau (7800 ft.), 1, Oct. 9.

20. **Cricetomys gambianus elgonis** *Thomas.*

Five specimens, 2 males, 3 females (all adult): Elgeyo Forest (6000 ft.), 3, Jan. 26, 27; Uasin Gishu Plateau (7800 ft.), 2, Oct. 2.

Collector's measurements: 2 males, total length, 792, 761; head and body, 398, 380; tail, 394, 381; hind foot, 76, 75: 3 females, 692, 704, 727; 365, 330, 330; 362, 362, 274; 73, 76, 73.

Skull,	occipitonasal	length,	♂ 75;	zygomatic	breadth,	35.
"	"	"	♂ 75;	"	"	36.
"	"	"	♀ 71;	"	"	—
"	"	"	♀ 71;	"	"	34.
"	"	"	♀ 71;	"	"	35.6.

21. **Œnomys hypoxanthus bacchante** *Thomas.*

One specimen, adult male, Uasin Gishu Plateau (6000 ft.), Dec. 25.

22. **Epimys tullbergi peromyscus** *Heller.*

Three skins with skulls and one additional skull, Uasin Gishu Plateau (7800 ft.), Oct. 2, 11.

23. **Epimys hindei medicatus** *Wroughton.*

One specimen, Uasin Gishu Plateau, Dec. 29.

24. **Otomys irroratus elgonis** *Wroughton.*

Eight specimens (4 adult, 4 juv.): Elgeyo Forest (6000 ft.), 7, Jan. 17–26; Uasin Gishu district (7800 ft.), 1, Oct. 9.

25. **Tatera dundasi** *Wroughton.*

Two specimens, Uasin Gishu Plateau, Oct. 16.

26. **Heliosciurus rufobrachiatus nyansæ** *Neumann.*

One specimen, Uasin Gishu Plateau (7800 ft.), Oct. 6.

27. **Felis pardus suahelica** (*Neumann*). East African Leopard.

Three specimens, 2 males, 1 female, all adult: Elgeyo Forest (6000 ft.), male, Jan. 23; Cheringangi Hills (6400–9000 ft.), male and female.

Collector's measurements: total length, ♂♂ 1807, 2135, ♀ 1778; tail vertebræ, ♂♂ 685, 927, ♀ 750; hind foot, ♂♂ 267, 223 (?), ♀ 235.

28. **Felis serval serval** *Schreber.* Serval Cat.

Two specimens, adult males, Uasin Gishu Plateau (6000 ft.), Dec. 25 and 27.

Collector's measurements: total length, 790, 1092; tail vertebræ, 229, 280; hind foot, 140, 197.

29. **Bedeogale crassicauda jacksoni** (*Thomas*).

Six specimens, 4 males, 2 females, Elgeyo Forest (6000 ft.), Jan. 19–27. All are adult except one of the males, which has just acquired the permanent dentition, the canines being still only about half up.

Collector's measurements: 3 adult males, total length, 854 (835–863); tail vertebræ, 316 (301–324); hind foot, 107 (105–108); 2 females, total length, 800, 838; tail vertebræ, 508, 527; hind foot, 292, 311. Skull: 3 males, condylobasal length, 109.3 (110, 110, 108); zygomatic breadth, 58 (59, 58, 57); 2 females, 102, 103; 54, 55.

There is also a specimen (skin only) in the Museum collection from Nairobi, and another from Komphombene referable to this subspecies.

30. **Nandinia binotata arborea** *Heller.*

One specimen, adult male, Elgeyo Forest (6000 ft.), Jan. 25. (Compared with type.)

Total length, 1083; tail vertebræ, 581; hind foot, 100. Skull, condylobasal length, 101; zygomatic breadth, 65.

31. **Genetta bettoni** *Thomas.*

Eight specimens, 5 males, 3 females, all adult, Elgeyo Forest (6000 ft.), Jan. 16–28.

Collector's measurements: 5 males, total length, 823 (790–855); tail vertebræ, 380 (361–400); hind foot, 80.6 (76–85); 3 females, 802 (793–814); 365 (359–368); 76 (73–79).

Skulls: males, condylobasal length, 81.4 (79–82.5); zygomatic breadth, 39.7 (38–40.5); 3 females, 79 (78.5–80); 37.4 (36–40).

In general coloration the series is unusually uniform, the chief variation being that some specimens are slightly darker than others in general effect. The number of light rings on the tail is usually 9, with a light brownish tip, but varies from 8 to 10. The width of the white tail rings varies from one fourth to one half of the width of the black interspaces.

32. **Genetta pardina** (? **stuhlmanni** *Matschie*).

Three specimens, 1 male, 2 females (all adult), Elgeyo Forest (7000 ft.), Jan. 15, 20, and 26.

These specimens vary greatly in coloration, the male being of the usual color, with all the light tail-rings clear white on dorsal and lateral sides, yellowish white on ventral; one of the females is heavily suffused with fulvous, and has the light tail-rings yellowish white below and deep yellowish rufous above; the other female is entirely brownish black with the dark markings deep black — a beautiful example of melanism.

Collector's measurements: total length, ♂ 877; ♀ 822, ♀ 919 (melanistic); tail vertebræ, ♂ 412, ♀ 391, ♀ 431; hind foot, ♂ 89, ♀ 81, ♀ 84.

Skull: condylobasal length, ♂ 89, ♀ 83.5, ♀ .87; zygomatic breadth, ♂ 45, ♀ 42.6, ♀ 45.5.

These specimens are provisionally referred to *Genetta stuhlmanni* Matschie.

33. **Canis mesomelas** *Schreber*.

Three specimens, adult males. Uasin Gishu Plateau (7200–7900 ft.), Oct. 25–27.

Collector's measurements: total length, 984, 1030, 1005; tail vertebræ, 325, 341, 330; hind foot, 160, 160, 153.

34. **Canis lateralis** *Sclater*.

One specimen, adult female, Uasin Gishu Plateau (7900 ft.), Oct. 27.

Collector's measurements: total length, 1668; tail vertebræ, 350; hind foot, 165.

35. **Lavia frons frons** (*Geoffroy*).

Two specimens, Uasin Gishu Plateau, Dec. 23.

36. **Crocidura flavescens nyansæ** *Neumann*.

One specimen, Elgeyo Forest, Jan. 27.

37. **Galago braccata albipes** *Dollman*.

Two specimens, adult male and female, Uasin Gishu Plateau (6000 ft.), Dec. 29.

Collector's measurements: total length, ♂ 406, ♀ 438; tail vertebræ, ♂ 247, ♀ 260; hind foot, ♂ 70, ♀ 70.

38. **Lasiopyga** sp. indet.

Two specimens, adult females, Cheringani Hills (6400 ft.), Nov. 5. Collector's measurements: total length, 933, 940; tail vertebræ, 121, 130.

39. **Erythrocebus whitei** *Hollister.*

Seven specimens, practically topotypes: 2 young adult males, 1 old female, and 4 young, one fourth to one half grown, all from Uasin Gishu Plateau (6000–7900 ft.), Oct. 19–26 and Dec. 27. Also an adult male from "Uganda," collected by Dr. Rainsford on a previous expedition and presented by him to the Museum.

Collector's measurements: old ♀, total length, 1865; tail vertebræ, 547; hind foot, 167.

40. **Colobus abyssinicus roosevelti** *Heller.*

Seven specimens: Uasin Gishu Plateau (6700 ft.), Oct. 1, 10, 2 males and 1 female; Elgeyo Forest (7000 ft.), Dec. 30, Jan. 13, 14, 21, 28, 4 females (only one adult) and 1 young one, probably not more than two weeks old, in the short, woolly first pelage. It is white except the muzzle and the face to a little behind the eyes, the hands and feet, and the apical third of the tail (except the extreme tip), which parts are blackish, or grizzled with blackish; the shoulders and forearms are slightly grizzled or grayish.

Collector's measurements: 3 adult males, total length, 1174, 1232, 1283; tail vertebræ, 565, 560, 565; hind foot, 165, 165, 180.

59.57.68C

Article XXVII.— A NEW SPECIES OF *CRIOCEPHALUS.*

By Andrew J. Mutchler.

Assistant, Department of Invertebrate Zoölogy.

In a collection of Coleoptera sent to the Museum by Mr. Charles T. Ramsden of Guantanamo, Cuba, was a Longicorn of the genus *Criocephalus.* No species of this genus has been recorded from the West Indies, but as Dr. Sharp states (Transactions of Entomological Society of London, 1905, pp. 145–164), "the genus *Criocephalus* is distributed over the northern hemisphere, occurring in about equal numbers in the Old and the New Worlds; it does not pass the equator and scarcely touches the tropics, except in the highlands of their northern parts."

The distribution of the North American species is as follows: *Agrestis,* the first species recorded from this continent, was described by Kirby (Fauna Boreali-Americana, part IV, 1837, p. 170) under the name of *Callidium agreste.* He stated that several specimens were taken on the Franklin Expedition, and likewise in Nova Scotia by Dr. MacCollouch and Capt. Hall. The distribution as now recorded, is Canada and the United States east of the Rocky Mountains. *Obsoletus* was described by Randall in his paper on 'New Species of Coleopterous insects of Maine,' (Boston Journal of Natural History, Vol. II, 1838, p. 27), as *Callidium obsoletum.* The later records of this species show it to be widely distributed, extending from Canada to Mexico. It is apparently common in the pine forests at the higher elevations in the latter locality. Leconte in the Journal of the Academy of Natural Sciences of Philadelphia, Vol. II, Second Series (1850–1854, pp. 35 and 36) described the following four species: *Australis* was placed under the generic name of *Asemum,* the type locality being given as Georgia. I can find no other locality records for this species. *Productus* was described from Oregon and later records are Vancouver Island, Montana, Washington and California. The type locality of *nubilis* is not given, but the species is probably confined to the southeastern United States. There are specimens in the Museum collection from Sanford, Florida. The other species (*obscurus*) was later found to be synonymous with *obsoletus.* In a paper on the Coleoptera of Kansas and Eastern New Mexico (1859, p. 19) the same author described *asperatus,* giving no specific type locality. Later records show it to be apparently common in the northwestern part of North America, its distribution extending from Montana to Mexico. The last

species of this genus described by Leconte (Smithsonian Miscellaneous Collection, XI, no. 264, 1873, p. 170) was *montanus*. The type locality is given as Colorado and there seems to be no later record for this species.

For a period of forty years no new species of this genus were recognized but in 1913 Colonel Casey (Memoirs Coleoptera, III) described five, namely, *honduranus* from Honduras; *filitarsis*, El Paso, Texas; *cavicollis*, Colorado; *lacustrinus*, Bayfield, Wisconsin, and *cervinus* from Indiana. The present species extends the range of this genus to the West Indies.

As far as known, this genus feeds exclusively on conifers. I have inquired of Mr. Ramsden if there are any pine trees in the vicinity of Guantanamo and he replied that "there are pine trees in the hills some twenty miles north, as the crow flies, and as I have been collecting all over the place, it may be that this specimen came from there."

The Cuban specimen resembles in general appearance *asperatus* LeConte but differs from it in that the terminal four joints of the antennæ are longer, the eighth joint being more than three-fifths as long as the sixth, while in *asperatus* the eighth joint is scarcely one-half as long as the sixth. The sculpture of the elytra in *asperatus* is obsolete and this species is subrugosely punctate. Also the gular area in *asperatus* is covered with a brush of hair, while in this species it is closely punctate and with only a few scattered hairs.

Criocephalus cubensis n. sp.

Elongate subcylindrical; dark sooty brown; antennæ about two-thirds as long as the body, last four joints subequal, shorter than the preceding; the eighth joint more than three-fifths as long as the sixth; head medially impressed to near the base, closely and deeply punctate. Thorax subangulate at sides, rugosely sculptured, elevations more dense at the sides and with a shallow oval impression at the middle near the base, and two deep, sublateral oval impressions. Elytra subrugosely punctate, shining, covered with short, microscopic hair; disk with two costæ reaching from the base to near the apex and a third ill-defined costa near the lateral margin from about the basal third to near the apex, the last named joining in a curve with the discal costæ; a slight depression at the suture near the apex, separately rounded apices. Body beneath; the gular area is deeply and somewhat closely punctate, with a few scattered hairs; prosternum shining, sparsely covered with hair; mesosternum covered with hair at the apex and sides, base nearly nude; ventral segments hairy, the hair being longer and thicker at the articulations. Legs of the same general color as the body, are also sparsely covered with pubescence. The pubescence throughout of a golden-brown, especially noticeable on the mesosternum, much lighter than the ground color of the body.

Length 26 mm., width 7.5 mm. From Guantanamo, Cuba, May 20, 1913. At light, Chas. T. Ramsden, Collector.

Type: Coll. A. M. N. H.

59.14,85,7: 9,32(7)

Article XXVIII.— THE AUDITORY OSSICLES OF AMERICAN RODENTS.

By T. D. A. Cockerell, Lewis I. Miller and Morris Printz.

In the course of some work on the classification and relationships of rodents, our attention was attracted to the auditory ossicles as being likely to afford significant characters. A very moderate amount of experience convinced us that these structures were indeed of considerable value for taxonomic purposes, and we accordingly followed up the subject as far as circumstances permitted. In addition to such specimens as we could collect in the vicinity of Boulder, we were permitted the use of numerous skulls of Rocky Mountain species in the University Museum, through the kindness of Professor J. Henderson. Our outlook was then greatly extended by the loan of a series of South American skulls from the American Museum of Natural History, through Dr. J. A. Allen; while the U. S. National Museum kindly loaned skulls of a number of African species. Quite recently the U. S. National Museum, through Mr. G. S. Miller, has loaned skulls of three Old World species of true Cricetinæ. We could not have made even a preliminary survey of the field without the kind assistance of the persons and institutions mentioned. The African skulls have been treated in a short separate paper, which has been sent to the 'Zoologischer Anzeiger'. The American genera are discussed herewith; and for purposes of comparison, the three genera of Old World Cricetinæ. We also include genera introduced or domesticated in America. It is obvious that the investigation could be greatly extended with advantage, but we think we have carried it far enough to bring out some of the leading facts, and indicate some of the lines along which further progress may be made.

The great classical work on ear-bones is of course that of A. H. G. Doran, 'Morphology of the Mammalian Ossicula Auditus,' Trans. Linnean Society, ser. 2, Zool., Vol. I, pp. 371–497, plates 58–64. We have referred to this throughout as "Doran." The number of species treated by this author is astonishing, and includes many which are rare or difficult to obtain. The descriptions are usually sufficient, and the figures, though rather small, are good.

Although Doran's work is excellent, caution is needed in its interpretation, and indeed in the use of any work on this subject. The conformation of the ossicles is such that they present difficulties analogous to those found by students of the genitalia of insects. That is, they have so many processes

and angles, curves and hollows, that their appearance is greatly altered by even a little change of orientation. A naïve examination of Doran's figures or our own might thus lead to quite mistaken conclusions. Sometimes, after making a drawing, we have found it quite difficult to rediscover the precise position which gave the outline presented. In addition, these small objects have to be studied under a low power of the compound microscope, and frequently some conspicuous feature will not be in focus in a view which best illustrates some other one. Hence the final drawings come to represent the use of several different foci, supplemented by the hand lens. In some cases the lateral processes of the malleus project directly toward the observer, and practically defy all attempts to clearly indicate their nature in a drawing.

The difficulties described are still further augmented by the effects of age and of individual variation, the latter in some cases being quite large. Nevertheless, in spite of all complications, the salient facts appear to be reasonably clear.

Doran has minutely described the human ossicles, comparing their features with those of various animals. It will be sufficient here to briefly enumerate the named parts of the bones, indicating their positions.

Malleus. The largest of the three bones, is more or less hammer-like, as the name indicates. The large upper part, or *head,* presents a broad articular surface for the incus. In rodent mallei the part below the head is usually much constricted, and is called by us the *cephalic peduncle.* From the side of the head arises the cephalic process or *processus cephalicus,* obliquely (or even vertically) directed downwards, and frequently bounding above and without a large thin plate or *lamina.* The lower side of the lamina is bounded by the *processus gracilis,* which is usually slender, evanescent apically, and arises from the more or less swollen region between the cephalic peduncle and the base of the manubrium. The *manubrium* or handle extends downwards, and is a more or less flattened structure, like a dagger or knife-blade, usually with thickened margins (when it is said to be bimarginate), with a thin lamina between. The outer edge, attached to the tympanic membrane, is usually broadened and spatulate at the lower end (though sharply pointed in lateral view), and ends above in a sort of heel-like process, the *processus brevis.* On the side of the manubrium opposite to the processus brevis, sometimes half-way down the manubrial margin, but often above the manubrial base, is usually seen the *processus muscularis,* for the attachment of the tensor tympani. There still remains a process, to which we attach considerable importance; the *orbicular apophysis.* This is usually formed like the end of a finger, and extends outward from the root of the manubrium, at right angles to the manubrial blade, and to the processi muscularis and brevis.

Incus. Consists of a body, articulated with the malleus; from this proceeds outward a *processus brevis;* and downward a long process, the *stapedial process* (or processus longus), which articulates with the head of the stapes. At the end of the stapedial process, actually attached to the head of the stapes, is usually seen a button-like object, the *sylvian apophysis.*

Stapes. This stirrup-shaped ossicle consists of a head, from which descend two crura, to a transverse base, the last consisting of a thickened margin, surrounding a foot-plate, which in certain genera is strongly convex. At the side of the head is often seen a distinct process, the *stapedial process,* for the insertion of the stapedius muscle. Between the crura, in most groups, a blood-vessel runs, and frequently this is enclosed in a bony *intercrural canal.*

We have had constantly before us the question whether the auditory ossicles might throw any light on the origin of the Rodentia: Broom (Bull. Amer. Mus. Nat. Hist., XXXIII, p. 131) remarks, after discussing *Polymastodon:* "We have altogether in rodents quite a number of resemblances to characters found in *Polymastodon.* Most likely they are all due to convergence, though the suggestion has been made by Ameghino that the Rodents have sprung from the Multituberculates, and one would like to hesitate before denying the possibility."[1] We have no evidence concerning the auditory ossicles of the Multituberculata, but perhaps some indirect indications may be obtained by comparison with the line leading through the series Monotremata, Marsupialia, Insectivora, Chiroptera, etc. Gregory (Bull. Amer. Mus. Nat. Hist., XXVII, p. 467) represents the Rodentia as springing from some undiscovered placental type at the very base of the placental series, but nearest to the stem leading to Insectivora, Chiroptera and Primates. On p. 332 of the same work, Gregory concludes that "it seems not improbable that the stem forms of the Rodentia were Mesosoic Placentals, allied to the ancestors of the modern Insectivora and possibly to the contemporary ancestors of one or more of the Paratherian or Edentate orders."

While we cannot pretend to do anything more than indicate a few suggestive facts, these may not be without weight when considered in relation to the general structure of the animals.

(1.) The well developed orbicular apophysis of the malleus in the Myomorpha parallels the condition found in Chiroptera (as we have seen in a study of the ossicles of bats now in progress) and in Insectivora. We find, however, that the orbicular apophysis is absent in the Arvicolidæ and in the true (Old-World) Cricetinæ. The question arises, whether we are to con-

[1] Any connection between Rodents and Multituberculates is quite untenable if the characters and relationships of *Paramys* are taken into consideration. This genus is the oldest known rodent and represents approximately the primary type of the Simplicidentate families. The progressive specialization of each group can be traced more or less exactly from this primary type. The characters on which Ameghino and Broom rely in comparing rodents with Multituberculates are without exception secondary specializations. There are none of them present in *Paramys* save for the "diprotodont" specializations, which are present in several other unrelated phyla. Comparison of the skull or skeleton of Multituberculates with *Paramys* (which is contemporary with the last of them) shows not the least suggestion of relationship.— W. D. Matthew.

sider that the primitive Myomorpha possessed the apophysis, and that the Arvicolidæ and Cricetinæ have (apparently quite independently) lost it; or that the ancestors of the group had no apophysis, and those which still lack it are to that extent more primitive. Of these alternatives, the first is surely the more probable; but on similar grounds we must believe that the Myomorpha have not descended from close relatives of any of the other rodent groups. This idea is supported by Matthew, who (Bull. Amer. Mus., N. Hist., XXVIII, p. 67) represents the Myomorpha as arising *independently* from the Ischyromyids during the Eocene. The supposition would then be that those Eocene Ischyromyids possessed the apophysis, and it may not be going too far to suppose that the common ancestor of these and of the Insectivora-Chiroptera stem, somewhere in the later Mesozoic, also possessed this structure.

(2.) When we think of the human malleus as the type of that ossicle, the bone in the Myomorphous rodents, with its great cephalic process and lamina, seems very highly specialized. Upon comparison with Doran's plates, however, it is seen that this type of structure is frequent, and apparently of very ancient origin. Doran remarks that the Myomorpha and Insectivora, which agree in possessing an orbicular apophysis, also have the laminated malleus; hence we seem to find new and additional reason for connecting the ancestors of the Myomorpha with those of the Insectivora, and for holding the Myomorphan malleus to be really primitive among the rodents, although our first natural supposition was that it must be highly specialized.

(3.) Doran remarks (with good illustrations) that "in the shrews, the Mylogalidæ, Talpidæ, Centetidæ, and Hedgehogs proper one common feature exists — a malleus with a wide lamina and a processus gracilis united to the tympanic ring after the fashion of the Marsupials — in short, a low type of malleus." Comparison may be made with the malleus of the opossum. Here we directly connect the structures observed in the Myomorpha, through those of the Insectivora, with those of the Marsupials and ultimately the Monotremes. It seems to amount to a demonstration that the cephalic process and broad lamina are ancient, not new structures; and that when they are absent or scarcely developed, they have been lost.[1]

[1] The Myomorpha retain several primitive characters in the osteology lost by the other groups. Prominent among these is the uninflected angle of the jaw, much more like that of *Paramys* and its allies.

If we interpret the loss of orbicular apophysis of the malleus as progressive, it would naturally be absent in the Arvicolines, the most progressive, recent, and modernized group, and in the higher (Palæarctic) members of the Cricetines, the group from which the Arvicolines are derived. The Arvicolines may be deserving of family separation; they certainly

I. ARVICOLIDÆ AND MURIDÆ.

By T. D. A. Cockerell and Morris Printz.

Text Figures 1–55, pp. 360–364.

As stated above, two groups of Muridæ (sens. lat.) lack the orbicular apophysis. One of these, commonly known as Microtinæ, we have ventured to separate as a family, for reasons given below, which might be supported by other anatomical characters, the discussion of which is outside the scope of this paper. A noteworthy feature in the skull is the usually prominent postorbital angle or process; evidently a typical character of the group, though evanescent in some of the smaller forms.

The case of the Cricetinæ is apparently a more or less parallel one. We were led to enquire into the matter by Doran's remark (without any figure) that in *Cricetus* "there is no orbicular apophysis." This seemed an astonishing statement, since this process is so well developed in all the American so-called Cricetinæ seen by us, as well as in the true Muridæ of the Old World. The examination of three species, representing as many genera, of true Cricetinæ has confirmed the absence of the orbicular apophysis, and taken with other characters, has seemed to abundantly justify the restriction of the group Cricetinæ to the old world genera related to *Cricetus*, leaving the American so-called Cricetines in a separate subfamily, for which Thomas has already furnished a name Sigmodontinæ.

We figure the mallei and incudes of the Cricetine genera examined, and would call attention to some of the more remarkable features.

Cricetus cricetus. (Near Magdeburg, Germany.)

Malleus. Head high and rounded; cephalic peduncle rather thick; articular surface large; lamina extensive; process gracilis very thin; processus muscularis large, at base of manubrium, which is slender and bimarginate.

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form a very distinct sub-family. I doubt the propriety of Sigmodontinæ as distinct from Cricetinæ.

The connection of the rodents with the insectivores and of these with the marsupials is supported by a whole series of osteological features, although for the most part they probably consist in the retention of primitive characters. Nevertheless the Simplicidentate rodents are a very clearly defined group osteologically in the Lower Eocene, when they first appear. The earliest tertiary Insectivora include a number of groups of quite remote relationship, definable only by possessing various primitive characters, and lacking the characteristic specializations of the other placental orders.

The position of the Lagomorpha is a difficult problem. Gidley thinks they have nothing to do with the rest of the Rodents and should be separated as a distinct order. Palæontology throws no particular light on this question. The earliest Lagomorphs are from the Lower Oligocene of U. S. (Leporidæ) and uppermost Eocene of Europe (Ochotonidæ) and are very close to the modern genera showing no notable approach to the Simplicidentates. They are certainly not derivable from *Paramys* or anything near it. The evidence here given does not confirm Gidley's view, although I should hesitate to say that it is clearly against it.— W. D. Matthew.

Incus. Curiously formed, with a very short truncate processus brevis; stapedial process long, ending in a cup-shaped sylvian apophysis, which has a very slender peduncle.

Cricetulus griseus. (Yu-Ling, China.)

Malleus. Head much less elevated and massive; lamina very extensive; processus muscularis rounded, well developed; manubrium bimarginate.
Incus. A small bone, with a massive but rather short processus brevis, and a slender straight stapedial process.

Phodopus bedfordiæ (Yuting-fu, China.)

Malleus. Head elevated, with a deep articular surface; lamina extensive; processus muscularis small and rounded; manubrium slender.
Incus. Articular surface broad and deep, saddle-like; processus brevis large, obtusely pointed; stapedial process rather short, with a large sylvian apophysis.

ARVICOLIDÆ.

Fiber zibethicus cinnamominus Hollister.

East of Boulder, Colorado (U. of Colorado Museum).
Malleus. Cephalic peduncle with a double curve, passing without much enlargement into the head proper, whence proceeds the long processus cephalicus, which is very stout basally, and gradually tapers, slightly curving as it approaches the exceedingly thin processus gracilis, the two enclosing a broad expanse of bony lamina. Orbicular apophysis absent. Manubrium bimarginate, with a flattened spoon-like distal end, in the manner of *Epimys;* processus muscularis at base of manubrium, as in *Mus.* This malleus is remarkable for the great development of the cephalic process. The figure does not show the manubrium.
Incus. Processus brevis rather poorly developed, short, rapidly tapering to a point, from which proceeds a ligament; stapedial process well developed, curving at its end, where it terminates in a well-developed sylvian apophysis. Articular surface for malleus exceedingly large, shallow, quadrilateral.
Stapes. Large, with symmetrical crura, which are long, slender, and not very divergent; head prominent; stapedial process small but distinct; foot-plate decidedly convex, surrounded by a symmetrical elliptical bony margin. Bony intercrural canal present. The base of the stapes has a diameter of about 1408 μ.

Microtus mordax (Merriam).

Pickwick Mine, Magnolia, Colorado (*J. D. Blanchard;* U. of Colorado Museum).

Microtus nanus (Merriam).

East of Boulder, Colorado (U. of Colorado Museum).
Malleus. This bone in *Microtus* is not unlike that of *Fiber*, and agrees with it in lacking the orbicular apophysis. Cephalic peduncle running straight up for some distance, then bulging to form part of the articular surface for the incus, passing

gradually into the thick head. Articular surface double and very shallow. Processus cephalicus well developed, sloping downward, rapidly tapering basally, and then continuing without much diminution of size. Processus gracilis slender, curved, long, with the cephalic process enclosing a subtriangular bony lamina. Manubrium bimarginate, broad, the distal end more distinctly spoon-shaped than in *Fiber;* processus muscularis basal as in *Fiber.*

Incus. Processus brevis short, pointed, with a ligament joining its extremity; stapedial process well developed, somewhat curved, ending in a very prominent sylvian apophysis. Articular surface large.

Stapes. Decidedly asymmetrical; crura rather short, divergent, one thicker than the other; foot plate broad, with a strong bony margin. A very large blood vessel passes between the crura, and in some cases a bony canal was present. Stapedial process distinct.

The two species of *Microtus* examined did not differ in any important character of their ossicles.

Doran examined the ossicles of *Arvicola amphibius, Microtus arvalis* and *Fiber zibethicus,* and remarks on the strong processus cephalicus of *Fiber.* Doran's figures of the mallei of *Arvicola* and *Fiber* suggest very different bones, but this is largely illusory, owing to the malleus of *Arvicola* having been drawn in such a position that the cephalic process, lamina and processus gracilis are not visible. The ossicles of *Arvicola* do not appear to differ materially from those of *Microtus.*

The Microtinæ differ from the true Muridæ in appearance, conspicuously in their teeth, and are peculiar for lacking the orbicular apophysis of the malleus. They seem to represent an ancient group, worthy of family rank. In Osborn's 'Age of Mammals,' p. 537, the Cricetinæ are included in the Microtinæ, but probably by an accident, as on p. 536 the Cricetinæ are given as a distinct subfamily. Matthew, Bull. Amer. Mus. N. Hist., XXVIII, p. 67, derives the Microtinæ (*Microtus* and *Fiber*) hypothetically from a common stem taking its origin in the Oligocene *Eumys,* a North American group. The American Cricetinæ are also supposed to be derived from *Eumys,* by another branch.

Following Miller in recognizing *Arvicola* as a distinct genus, we are able to recognize Gray's proposed name for the family, and the arrangement becomes:

Arvicolidæ Gray 1821. (*Microtidæ* Cope 1891.)
- Subf. *Lemminæ.* (*Lemmi* Miller 1896.)
- Subf. *Arvicolinæ.* (*Microti* Miller 1896.)
- Subf. *Myotalpinæ* Miller 1896. (*Ellobii* Miller 1912.) Doran describes the ossicles of *Ellobius.*

MURIDÆ.

NEOTOMINÆ.

Neotoma mexicanaofallax (Merriam).

Boulder Cañon, Colo. (*J. D. Blanchard*).

Neotoma (Teonoma) Ocinerea rolestes (Merriam).

Gregory Cañon, near Boulder, Colo. (*Printz and Miller*); Marchioness tunnel Boulder Cañon, Colo. (*Henderson and Blanchard*).

Malleus. Manubrium bimarginate, with no processus muscularis, but a distinct tubercle present above the orbicular apophysis; whether this tubercle receives the tensor tympani was not ascertained. Orbicular apophysis large. Cephalic peduncle elongated, terminating in a relatively small head, with the articular surface for the incus much less than in the Arvicolidæ. Bony lamina extensive; processus gracilis long.

In animals of the same size, the malleus of *orolestes* was distinctly longer than that of *fallax*. In *orolestes* the cephalic peduncle has a distinct angular bend, whereas in *fallax* it is gently and more regularly curved. The orbicular apophysis in *fallax* lies almost in the same plane as the lamina, but in *orolestes* it is directed somewhat backward, out of that plane. The articular surface on the head of the malleus is higher and narrower in *fallax* than in *orolestes*.

Incus. Processus brevis thick and short; stapedial process long, with a distinct and well-developed sylvian apophysis, which is more easily separated from the stapes in *fallax* than in *orolestes*. Around the inner margin of the articular surface is a distinct broad groove. The whole inner side of the incus presents a concavity or groove, which is however variable in extent; it may be absolutely continuous with the articular surface. The incudes of the two species examined do not differ nearly so much in size as do the stapedes; there is also rather noteworthy variation in size between individuals of the same species.

Stapes. A stout bony intercrural canal is present.

The size of the ossicle differs in the two species, and this difference is not in proportion to the size of the skull, or to the size of the other ossicles. Thus: Skulls: *orolestes*, 4.5 cm. long; *fallax*, 4.3 cm.; ratio 100:95. Height of stapes: *orolestes* 985 μ; *fallax*, 848; ratio 100:86. Breadth of base of stapes: *orolestes*, 848 μ; *fallax*, 672; ratio 100:79.2. The crura of *fallax* are more divergent and less arched than those of *orolestes*, but in both one crus is shorter and straighter than the other, making the ossicle asymmetrical, this being especially marked in *orolestes*. In *fallax* the foot-plate is more convex than in *orolestes*. Individuals of *fallax* showed some remarkable variation in the processes of the stapes. In one example there was a distinct process on the inner surface of each crus, presumably connected with the intercrural canal. In this individual there was no stapedial process (for the stapedius muscle), but another individual of *fallax* had the stapedial process well developed. No stapedial process was found in *orolestes*.

Murinæ.

Epimys norvegicus (Erxleben).

Boulder, Colorado (*Printz and Miller*); Bloomington, Indiana (*Max M. Ellis*).

Malleus. Lamina well developed, with subtriangular outline; processus gracilis thin; cephalic peduncle scarcely curved, gradually passing into the head, which has a short articular surface as in Neotominæ (thus quite different from Arvicolidæ); articular surface deep, its margins presenting two conspicuous projections; cephalic process heavy, gradually tapering, its base much broader than in *Neotoma;* orbicular apophysis well developed, but much smaller in proportion to the rest of the ossicle than that of *Mus.* Manubrium bimarginate, its distal end flattened, spatulate, heel or processus brevis distinct. The processus muscularis exists as a tubercle near the upper side of the base of the orbicular apophysis, evidently corresponding to a similarly placed tubercle in *Neotoma.*

Incus. Heavy and compact, with the stapedial process very stout, with a narrow curved concavity running down its inner surface; articulating surface double, very broad; processus brevis short, pointed. Sylvian apophysis developed.

Stapes. Strongly asymmetrical, one crus being much shorter and straighter than the other; stapedial process small but distinct, at the junction of the head with the crus; foot-plate flat. No intercrural bony canal was found, but a blood-vessel passes between the crura.

Mus musculus L.

Boulder, Colorado.

Malleus. Readily distinguished from that of *Epimys norvegicus;* lamina with a subquadrate outline; processus gracilis quite heavy; cephalic peduncle with an angular bend (compare *Neotoma orolestes*); articular surface low and rather wide; orbicular apophysis large and prominent; processus brevis distinct; manubrium bimarginate, the inner margin very thin.

Incus. Difficult to separate from the malleus. Processus brevis prominent, and much thicker than the stapedial process, which it nearly equals in length. Sylvian apophysis present.

Stapes. Even more asymmetrical than that of *Epimys;* one crus practically straight, the other strongly arched; stapedial process obtuse but distinct; head large, foot-plate distinctly convex. A blood vessel, but no bony canal, passes between the crura.

Doran figures and describes the ossicles of the Australian *Conilurus mitchelli,* and it is evident that they differ only a little from those of *Epimys.* The incus has the same very thick stapedial process; the stapes seems to be more symmetrical; the orbicular apophysis is less robust. Doran says that the manubrium is rather shorter than in *Mus,* but his figure represents it as longer.

SIGMODONTINÆ.

(*Sigmodontinæ* Thomas, Proc. Zool. Soc. Lond. for 1896 (1897), p. 1019.)

Peromyscus nasutus (Allen).

Gregory Cañon, Boulder, Colorado (*Printz and Miller*).

Peromyscus truei (Shufeldt).

Rito de los Frijoles, New Mexico (*J. Henderson and W. W. Robbins*).

Malleus. Orbicular apophysis long and narrow, at right angles to the manubrium (it forms an acute angle with the manubrium in *Nectomys*, *Melanomys*, &c); cephalic peduncle thick basally, abruptly bending almost at a right angle, the portion between the bend and the head very thin; articular surface small and short, bounded externally by a considerable elevation; cephalic process very thin, oblique, with an outward slope; lamina broad and extensive; processus gracilis exceedingly thin; processus muscularis a large tubercle in the neck region, at the base of the orbicular apophysis; processus brevis obsolete; manubrium long, bimarginate, the distal end not spatulate.

Incus. Processus brevis thick, with a blunt apex, to which a ligament is attached; stapedial process moderately long, but thin, with a well developed sylvian apophysis.

Stapes. Head broad; crura thick and little divergent; stapedial process well developed; foot-plate slightly concave; intercrural canal present.

The two species examined presented no important differences. In the figure of *P. truei* the orbicular apophysis appears to have a different direction from that of *P. nasutus*, but this is owing to the position of the ossicle.

Oryzomys pectoralis Allen.

Cauca, Colombia; Popayan, ♂ ♀ (A. M. N. H. 32557, 32559).

Malleus. Orbicular apophysis relatively short; cephalic peduncle with an almost rectangular bend; articular surface small, its outer border less elevated than in allied genera; cephalic process thin, directed somewhat inward (thus different from *Peromyscus*, but not unlike that of *Melanomys*, in which it is vertical); processus gracilis thick basally, tapering to the apex; processus muscularis a prominent tubercle near base of manubrium; processus brevis obsolete; manubrium bimarginate.

Incus. Processus brevis rather long and narrow, distinctly curved; articular surface broad and double; stapedial process thin and moderately long, with a sylvian apophysis. In *Oryzomys* and *Peromyscus* the stapedial process of the incus reaches about or nearly as far as the bend in the cephalic peduncle of the malleus.

Melanomys chrysomelas (Allen).

Guerre, Costa Rica, ♀ (A. M. N. H. 9074/10775); Chontales, Nicaragua, ♀ (A. M. N. H. 29556).

Malleus. Orbicular apophysis thick, about as long as broad, with a transverse constriction; cephalic peduncle slender, the abrupt rectangular bend near the base; articular surface small, its outer margin elevated; cephalic process vertical; lamina large, subquadrate; processus muscularis large; processus brevis obsolete; manubrium bimarginate, not spatulate at end.

Incus. Cephalic portion long, forming an obtuse angle with stapedial process; processus brevis small and pointed, with a slight curve; stapedial process thickened distally, with a fairly large sylvian apophysis.

Nectomys palmipes Allen and Chapman.

Princestown, Trinidad. ♂ (A. M. N. H. 4667).

Malleus. Resembles in many ways that of *Mus;* orbicular apophysis very large, directed obliquely downward, forming an acute angle with the manubrium; cephalic peduncle thick, with a rectangular bend; head rather large, with a saddle-shaped articular surface, the outer margin strongly elevated; cephalic process thick; processus gracilis thick at base, tapering apically; lamina oblong; manubrium bimarginate, the margins quite heavy, and the processus brevis obsolete. A small tubercle above the base of the manubrium appears to represent the processus muscularis.

Incus. The most peculiar Sigmodontine incus seen. Processus brevis ill-developed, short and broad, obtuse; head large, with a broad articular surface, grooved to fit the saddle of the malleus; stapedial processes heavy, with a rectangular curve before the end, which has a very well developed sylvian apophysis.

Sigmodon sanctæ-martæ Bangs.

Onaca, Colombia (A. M. N. H. 15252).

Malleus. Orbicular apophysis longer than broad; cephalic peduncle curved, not abruptly bent as in the genera described above; head very thick and heavy, with a broad shallow articular surface, its outer surface strongly convex; processus gracilis large, laminate beneath; processus muscularis long and well developed, near the base of the manubrium; processus brevis obsolete; manubrium bimarginate, poorly developed or imperfect in our material.

Incus. Processus brevis rather small, thick at base, rapidly tapering to a pointed end; stapedial process heavy but not very long; a large pedunculated sylvian apophysis.

Akodon tolimæ Allen.

Rio Toché, Cauca, Colombia, ♀ (A. M. N. H. 32995).

Malleus. Orbicular apophysis short and heavy, as broad as long; cephalic peduncle thick basally, bent, but not to a right angle; head slight, with a prominent point bordering the articular surface on the inner side, but none on the outer; cephalic process moderately oblique, sloping outward, not strongly differentiated from the head; lamina large; manubrium with distal end spatulate.

Incus. Processus brevis small, pointed; stapedial process rather long, somewhat twisted, longitudinally ridged; sylvian apophysis circular, flattened, at right angles to the stapedial process.

There is a bony canal between the crura of the stapes.

When working with this animal we noted that it appeared doubtfully congeneric with *A. teguina* (Alston) from Guatemala, the teeth being noticeably different and the incisive foramina very much longer in *A. tolimæ.* (In the oldest known supposed

ancestors of the whole group, *Paramys*, the incisive foramina are comparatively very small and short.) Dr. J. A. Allen kindly informs us that Oldfield Thomas, Ann. Mag. Nat. Hist., (8). xi, p. 408 (April 1913), made *A. teguina* the type of a distinct genus *Scotinomys*. *A. tolimæ* is a typical *Akodon*.

Ichthyomys hydrobates Thomas.

Merida, Venezuela, ♀ (A. M. N. H. 24355).

Malleus. Orbicular apophysis small; cephalic peduncle thick, without the bend seen in the other genera, passing gradually into the thick head, the distal end of which (bounding the articular surface) is much produced; processus gracilis thin; manubrium bimarginate.

Incus. Processus brevis rather short, pointed, and with a small lateral projection; articular surface very broad; stapedial process rather long, thin, ridged externally; sylvian apophysis circular, pedunculated.

Phyllotis boliviensis (Waterhouse).

San Antonio, Peru, ♀ (A. M. N. H. 16494).

Malleus. Exceedingly large, being much larger than that of *Sigmodon sanctæmartæ*, the skull of which exceeds that of *P. boliviensis* in size; the transverse diameter, from level of end of orbicular apophysis to level of outer wall of head, is 1920 μ, the corresponding measurement in the *Sigmodon* being 1700 μ; the vertical distance from level of end of orbicular apophysis to level of end of cephalic crest is 800 μ, the corresponding distance in the *Sigmodon* 720 μ. Orbicular apophysis long, with a somewhat constricted neck; base of cephalic peduncle very heavy, somewhat convex or humped on outer side, passing obliquely to the very abrupt though not rectangular bend; head with a saddle-like articular surface, the outer side of which is greatly elevated; cephalic process thin, almost vertical; processus gracilis thin, flattened; manubrium very long, longer than the malleus is broad, bimarginate, with a sharp apex. The processus muscularis is found at the base of the manubrium, as it runs into the neck, but at the base of the orbicular apophysis is a two-horned process, from which (Fig. 44) a short ligament passes to a long slender process of bone arising from the wall of the tympanum.

Incus. Processus brevis thick, conical, pointed, with a ligament attached to its end; articular surface double; stapedial process thick, longitudinally ridged, with a circular broad sylvian apophysis.

Stapes. Broad, rather short, distinctly asymmetrical; foot-plate convex; stapedial process very minute.

The following key will probably be found valid for the separation of the above genera, but it remains to be tested by the examination of a larger number of species. It is based on the malleus.

Orbicular apophysis very small, its length less than half diameter of articular surface; cephalic peduncle with no angular bend (Tribe Ichthyomyini)
Ichthyomys Thomas.[1]

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[1] Thomas states that the cœcum of this aquatic genus is nearly absent, and contrasts this with the large cœcum of terrestrial (vegetarian) Muridæ. In *Fiber zibethicus cinnamominus*, which is aquatic but also largely vegetarian, we find an enormous cœcum, resembling in general that of *Neotoma orolestes*, and proportionately longer than in *Mus*, *Peromyscus*, *Onychomys*, *Perodipus*, etc.

Orbicular apophysis much larger . . . . 1.

1. Outer border of articular surface not elevated, but inner border strongly elevated (Tribe Akodontini) . . . . *Akodon* Meyen.
   Outer border of articular surface strongly elevated, or (*Oryzomys*) moderately so . . . . 2.
2. Cephalic peduncle without an abrupt bend; head massive (Tribe Sigmodontini) *Sigmodon* Say & Ord.
   Cephalic peduncle with an abrupt bend (Tribe Peromyscini) . . . . 3.
3. Processus cephalicus vertical or even sloping inward . . . . 4.
   Processus cephalicus conspicuously sloping outward . . . . 5.
4. Bend of cephalic peduncle very abrupt, rectangular. (Incus with short processus brevis) . . . . *Melanomys* Thomas.
   Bend of cephalic peduncle less abrupt, not rectangular. (Incus with a long processus brevis) . . . . *Oryzomys* Baird.
5. Bend of cephalic peduncle forming a very obtuse angle; orbicular apophysis with a constricted neck . . . . *Phyllotis* Waterhouse.
   Bend of cephalic peduncle forming a right angle or almost . . . . 6.
6. Orbicular apophysis forming practically a right angle with manubrium *Peromyscus* Gloger.
   Orbicular apophysis forming an acute angle with manubrium. (Incus peculiar; see fig. 35.) . . . . *Nectomys* Peters.

Phyllotis antedates *Peromyscus*, but it is not necessary to form the tribal name from the oldest generic name. *Phyllotis* is rather aberrant in the group.

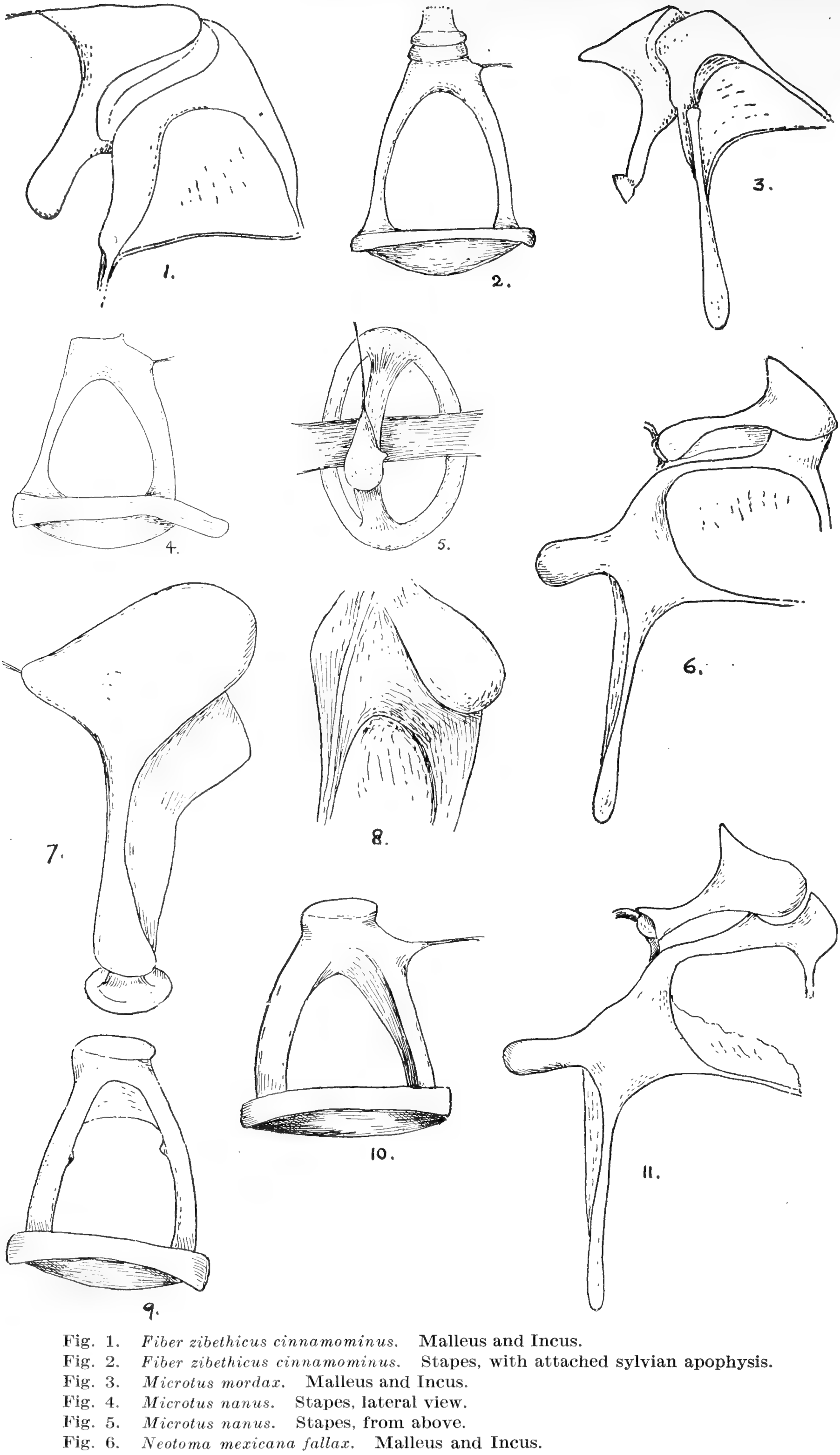

Fig. 1. *Fiber zibethicus cinnamominus.* Malleus and Incus.
Fig. 2. *Fiber zibethicus cinnamominus.* Stapes, with attached sylvian apophysis.
Fig. 3. *Microtus mordax.* Malleus and Incus.
Fig. 4. *Microtus nanus.* Stapes, lateral view.
Fig. 5. *Microtus nanus.* Stapes, from above.
Fig. 6. *Neotoma mexicana fallax.* Malleus and Incus.
Fig. 7. *Meotoma mexicana fallax.* Incus.
Fig. 8. *Neotoma mexicana fallax.* Base of manubrium.
Fig. 9. *Neotoma mexicana fallax.* Stapes.
Fig. 10. *Neotoma mexicana fallax.* Stapes.
Fig. 11. *Neotoma cinerea orolestes.* Malleus and Incus.

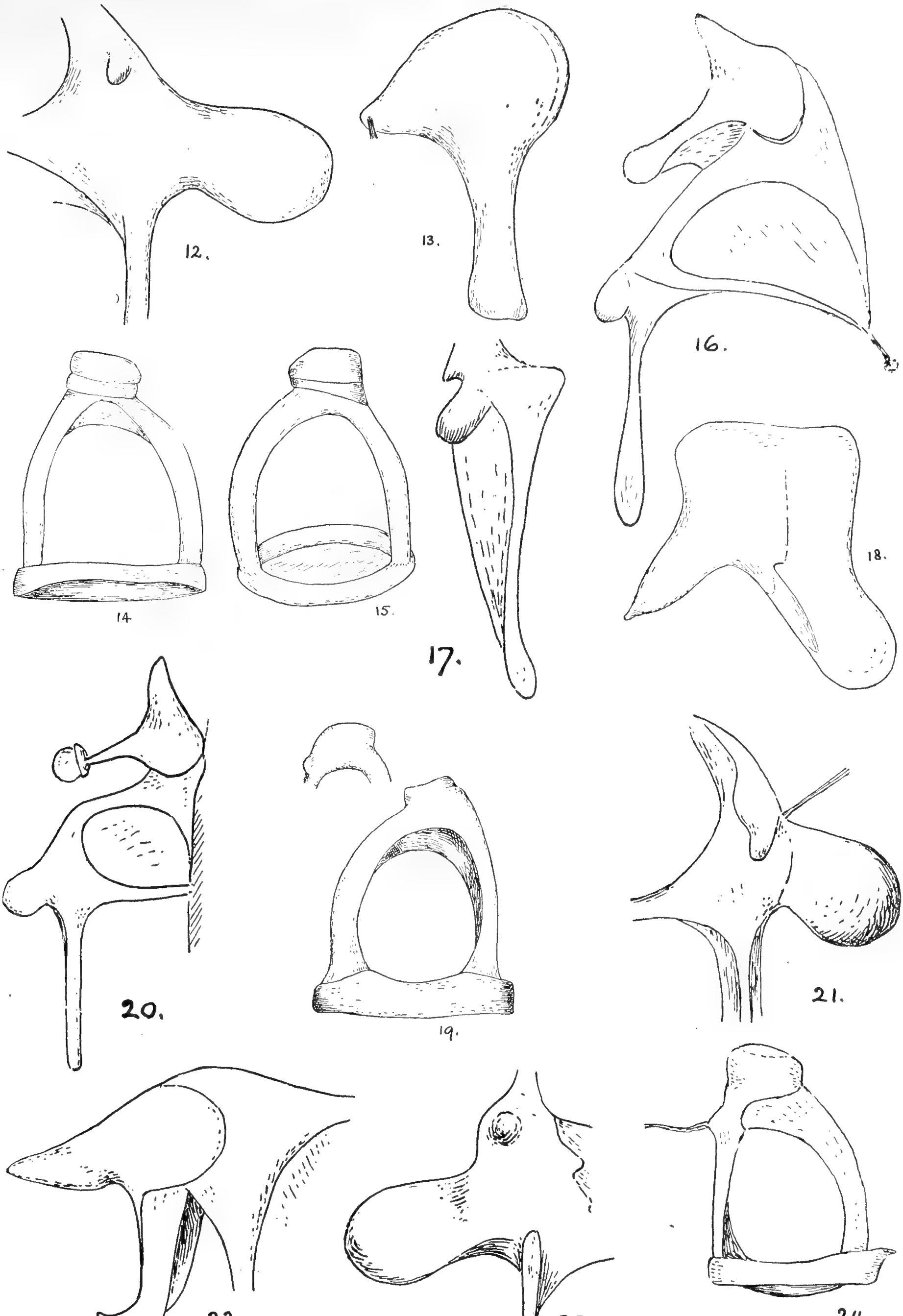

Fig. 12. *Neotoma cinerea orolestes.* Orbicular apophysis and adjacent parts.
Fig. 13. *Neotoma cinerea orolestes.* Incus.
Fig. 14. *Neotoma cinerea orolestes.* Stapes.
Fig. 15. *Neotoma cinerea orolestes.* Stapes.
Fig. 16. *Epimys norvegicus.* (Bloomington, Ind.) Malleus and Incus.
Fig. 17. *Epimys norvegicus.* (Bloomington, Ind.) Manubrium.
Fig. 18. *Epimys norvegicus.* (Boulder, Colo.) Incus.
Fig. 19. *Epimys norvegicus.* (Boulder, Colo.) Stapes.
Fig. 20. *Mus musculus.* Malleus and Incus.
Fig. 21. *Mus musculus.* Orbicular apophysis and adjacent parts.
Fig. 22. *Mus musculus.* Incus and part of Malleus.
Fig. 23. *Mus musculus.* Orbicular apophysis, Processus brevis, etc.
Fig. 24. *Mus musculus.* Stapes.

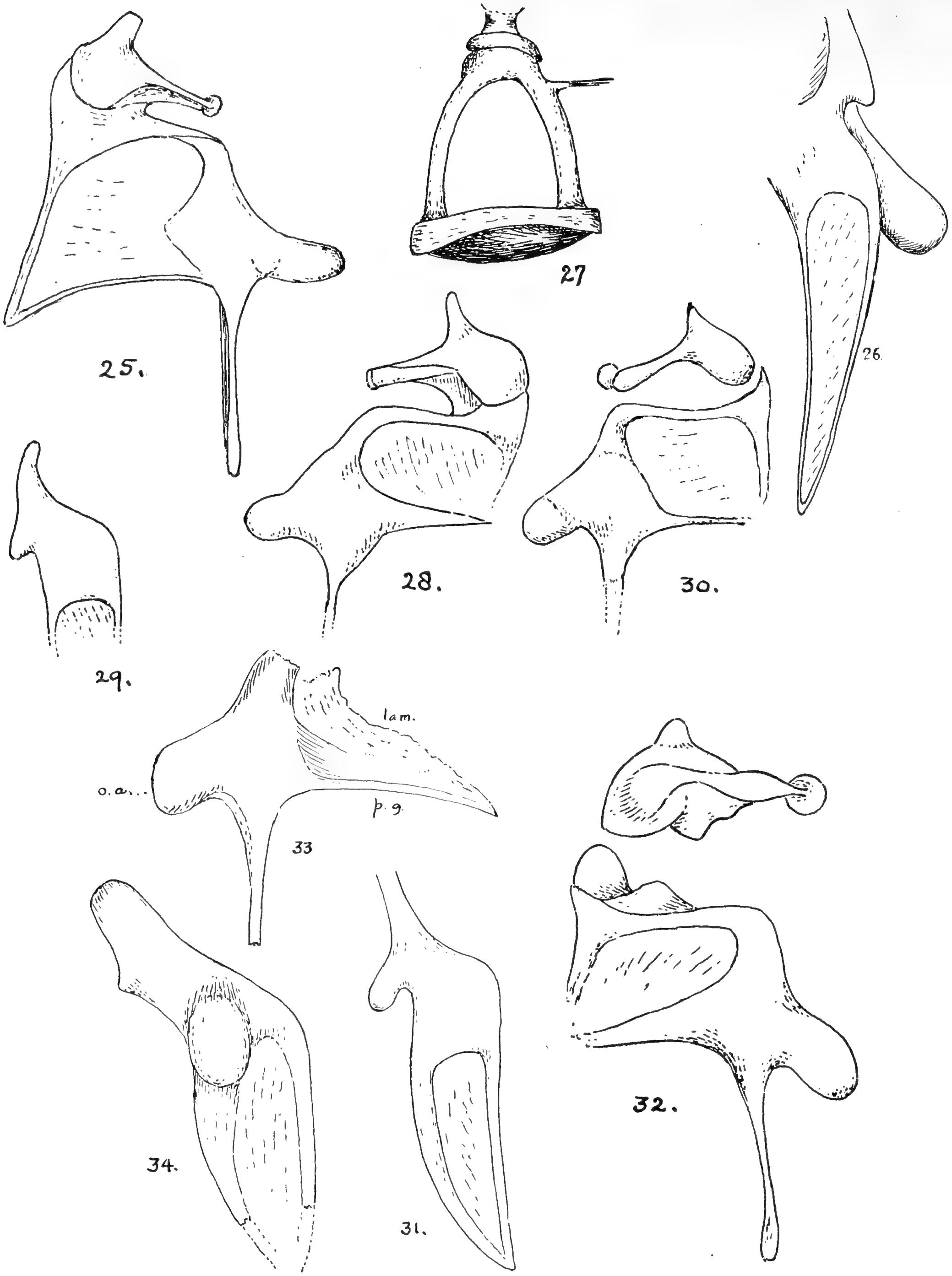

Fig. 25. *Peromyscus nasutus.* Malleus and Incus.
Fig. 26. *Peromyscus truei.* Manubrium.
Fig. 27. *Peromyscus truei.* Stapes.
Fig. 28. *Oryzomys pectoralis.* Malleus and Incus.
Fig. 29. *Oryzomys pectoralis.* Base of Manubrium.
Fig. 30. *Melanomys chrysomelas.* Malleus and Incus.
Fig. 31. *Melanomys chrysomelas.* Manubrium.
Fig. 32. *Nectomys palmipes.* Malleus and Incus.
Fig. 33. *Nectomys palmipes* Orbicular apophysis, Processus gracilis, etc.
Fig. 34. *Nectomys palmipes.* Manubrium.

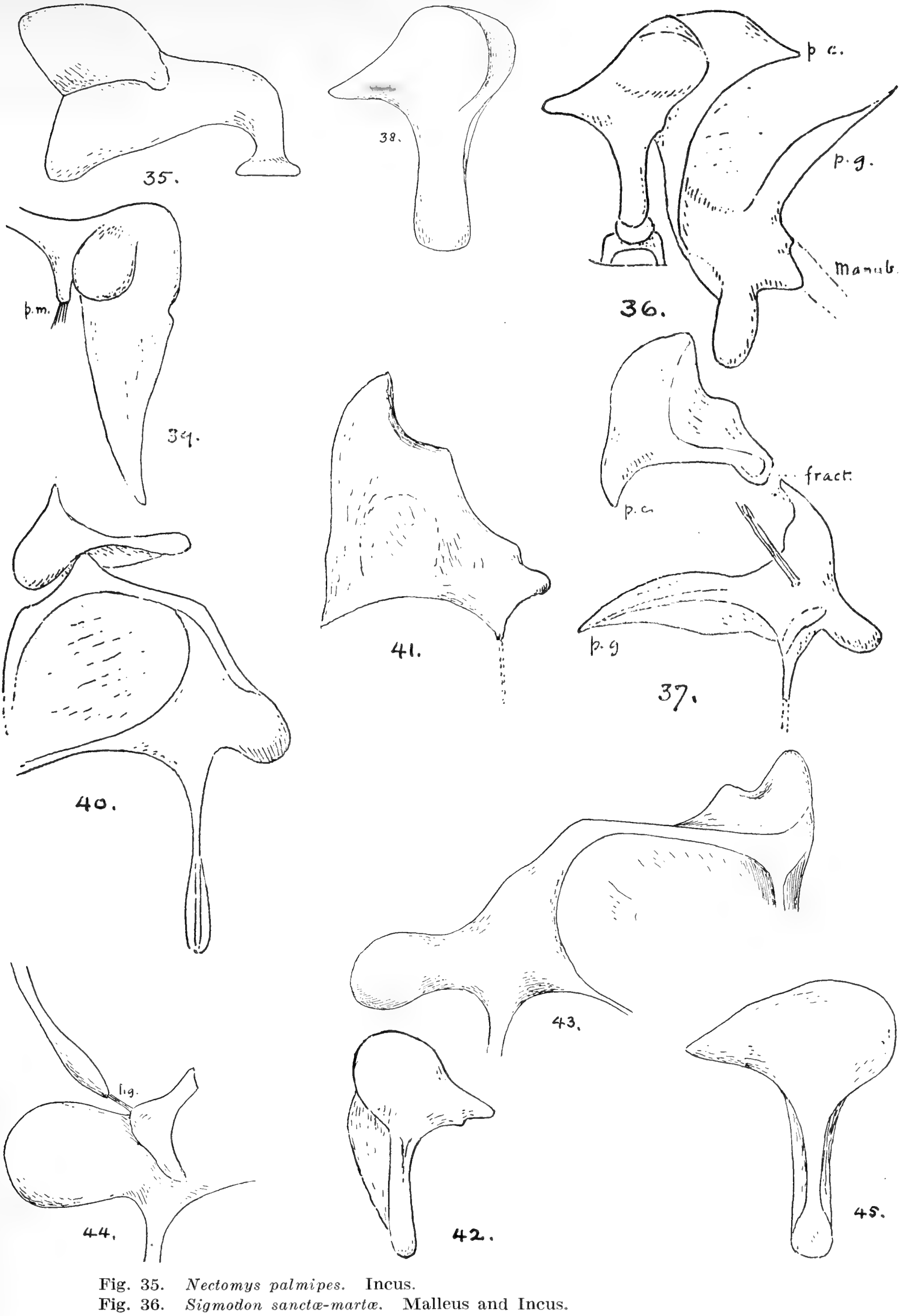

Fig. 35. *Nectomys palmipes.* Incus.
Fig. 36. *Sigmodon sanctæ-martæ.* Malleus and Incus.
Fig. 37. *Sigmodon sanctæ-martæ.* Malleus.
Fig. 38. *Sigmodon sanctæ-martæ.* Incus.
Fig. 39. *Sigmodon sanctæ-martæ.* Manubrium and Processus muscularis (p. m.).
Fig. 40. *Akodon tolimæ.* Malleus and Incus.
Fig. 41. *Ichthyomys hydrobates.* Malleus.
Fig. 42. *Ichthyomys hydrobates.* Incus.
Fig. 43. *Phyllotis boliviensis.* Malleus.
Fig. 44. *Phyllotis boliviensis.* Orbicular apophysis and adjacent parts.
Fig. 45. *Phyllotis boliviensis.* Incus.

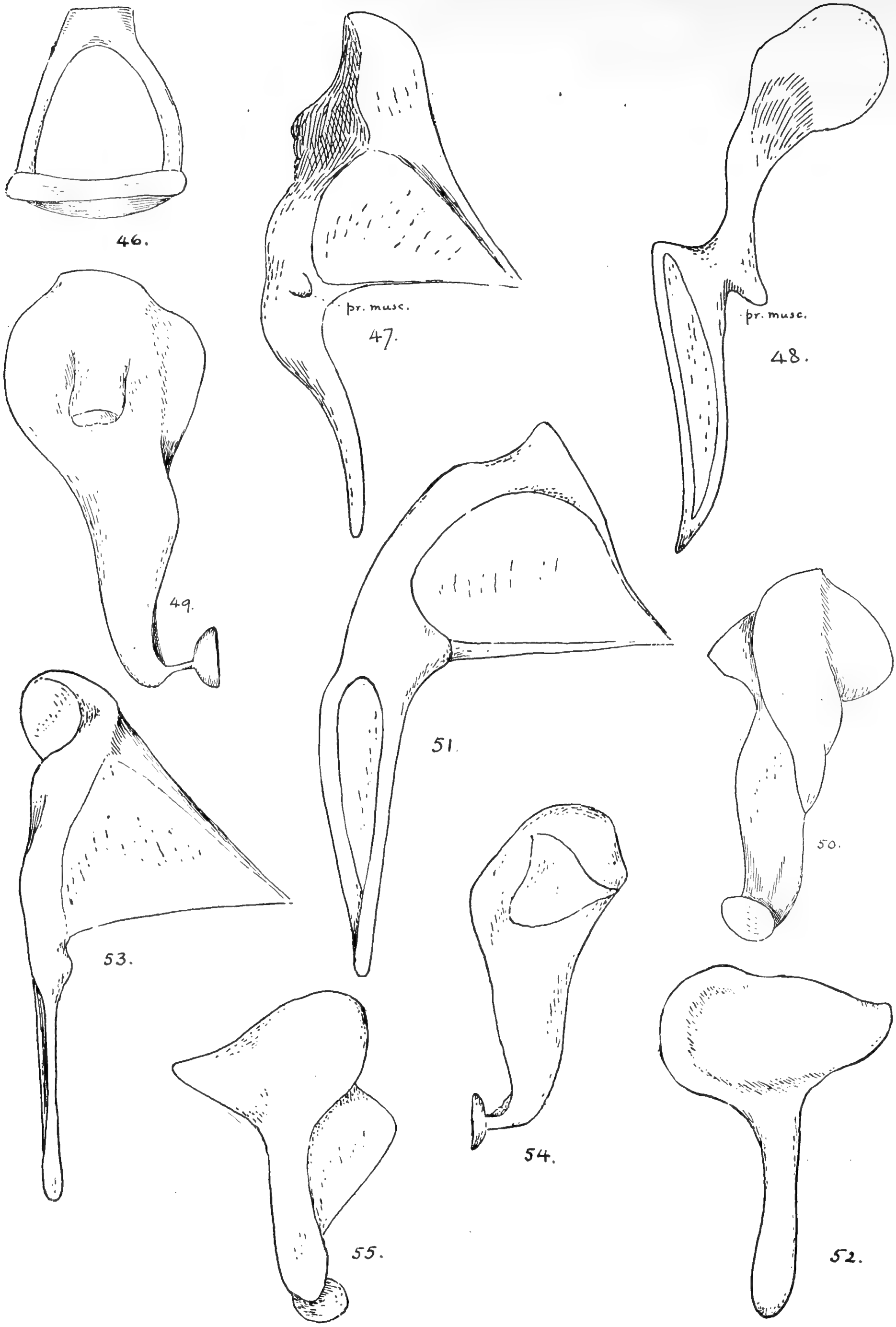

Fig. 46. *Phyllotis boliviensis.* Stapes.

Fig. 47. *Cricetus cricetus.* Malleus. Near Magdeburg. Germany: U. S. N. M. 153383.

Fig. 48. *Cricetus cricetus.* Malleus. Near Magdeburg, Germany: U. S. N. M. 153383

Fig. 49. *Cricetus cricetus.* Incus. Near Magdeburg, Germany: U. S. N. M. 153383

Fig. 50. *Cricetus cricetus.* Incus. Near Magdeburg, Germany: U. S. N. M. 153383

Fig. 51. *Cricetulus griseus.* Malleus. Shensi, Yu-Ling, China; A. de C. Sowerby, U. S. N. M. 155017.

Fig. 52. *Cricetulus griseus.* Incus. Shensi, Yu-Ling, China; A. de C. Sowerby, U. S. N. M. 155017.

Fig. 53. *Phodopus bedfordiæ.* Malleus. Shensi, Yuting-fu, China; A. de C. Sowerby, U. S. N. M. 155040.

Fig. 54. *Phodopus bedfordiæ.* Incus. Shensi, Yuting-fu, China; A. de C. Sowerby, U. S. N. M. 155040.

Fig. 55. *Phodopus bedfordiæ.* Incus. Shensi, Yuting-fu, China; A. de C. Sowerby, U. S. N. M. 155040.

II. FAMILIES OTHER THAN ARVICOLIDÆ AND MURIDÆ.

By T. D. A. Cockerell and Lewis I. Miller.

Text Figures 61–124, pp. 374–378.

LEPORIDÆ.

Oryctolagus cuniculus (L.).

Boulder, Colorado (domesticated.) "Belgian Hare."

Malleus. Head moderate, the rounded apex rising little above the articular surface; cephalic process directed laterad, short and pointed, but stout; a rudimentary lamina, extending from the processus cephalicus to the neck; processus gracilis quite rudimentary; articular surface rather deep; manubrium long, bimarginate, curved, sharply pointed as seen in lateral view, with a prominent heel (processus brevis); seen from the outer side the manubrium appears broad, parallel sided, rounded at either end; processus muscularis not clearly defined in our material, though Doran figures it as well developed.

Incus. Subquadrate, with the processus brevis short and rounded; stapedial process long, stout and curved, with a well developed elliptical sylvian apophysis. The incus has a strong general resemblance to that of the Sciuridæ.

Stapes. Thick, with a relatively small aperture between the crura; no stapedial process. We found no intercrural canal or bood vessel.

Sylvilagus auduboni minor (Mearns).

Mesilla Park, New Mexico.

Malleus. Head slightly more developed than in *Oryctolagus*, with the cephalic process oblique, and the lamina better developed.

Incus. Quadrate, and even more massive than that of *Oryctolagus*, but of the same general type. The ridge dividing the articular surface has a double curve, instead of being regularly concave as in *Oryctolagus*. The processes also differ in detail from those of the other genus; the processus brevis is truncate, while the stapedial process is larger and nearly straight. The stapedial process in *Sylvilagus* has a lateral bony lamina, absent from *Oryctolagus*.

Doran examined the ossicles of *Lepus europæus occidentalis* deWinton, and states that they are identical in form with those of *Oryctolagus cuniculus*.

OCHOTONIDÆ.

Ochotona saxatilis figginsi Allen.

Trappers' Lake, Garfield Co., Colorado (*A. H. Felger*).

The wall of the middle ear is thick, composed of cancellous bone, which in the lower part of the bulla has a thickness of fully 2 mm., greatly reducing

the tympanic space. There is nothing of this sort in the Leporidæ; but a similar condition, though less extreme, occurs in *Thomomys* and *Perognathus*, the latter having this feature least, though still well developed. The cochlea has a high spire.

Malleus. Similar in general to that of the Leporidæ, but still with very distinct features. Head not elevated above the articular surface; cephalic process directed laterad as in *Oryctolagus*, pointed; manubrium bimarginate, dagger-shaped, not curved, the outer margin narrower than in *Oryctolagus*, and spatulate apically; the upper part of the manubrium is divided by a very prominent partition, which isolates a deep cavity or excavation invading the lower part of the head, a feature apparently peculiar to *Ochotona*.

Incus. Elongated, with a triple articular surface; stapedial process very long, even longer than the body, having a lateral groove, but without a true sylvian apophysis, being merely broadened out at end, with a slight median depression; processus brevis very poorly developed, much smaller than in Leporidæ.

Stapes. Of the same general type as that of *Oryctolagus*, but broadened basally, so as to become more triangular in outline; intercrural aperture small, broad-oval; stapedial process evident. No intercrural canal.

The auditory ossicles merely support the opinion, previously based on many other good characters, that the Ochotonidæ constitute an exceptionally distinct family. We should like to know the physiological significance of the extraordinary condition of the tympanic walls, which we have determined to be perfectly normal by the examination of several skulls.

SCIURIDÆ.

Marmota flaviventer warreni Howell.

Between Meeker and Axial, Colorado (*A. H. Felger*).

Malleus. The sides are flatter than in *Sciurus*, and the head rises into a conspicuous blunt point high above the articular surface, which is deep and narrow; the manubrium is much broader at the base than in any true squirrel, though otherwise of the same type, with the extremity spatulate and the inner border angular; there is hardly a trace of a processus brevis. The elongated processus cephalicus, directed laterad and somewhat downward, is of the same general type as in other Sciuridæ.

Incus. Body wide, with the articular surface deeply cut; processus brevis pointed, rather short, more slender than in *Cynomys;* stapedial process very long and thick, broadened out at the end, but without a true sylvian apophysis. The processes are nearly at right angles to one another.

Stapes. Proportionately a very large ossicle, with a bony intercrural canal.

Doran's figure of the malleus of *Marmota marmota* (L.) looks quite unlike ours, being taken in a quite different position, but his description is applica-

ble, and has been partly repeated in the above account. From Doran's account the end of the manubrium is much less spatulate in *M. marmota* than in our animal. It is also evident that the stapedial process of the incus is longer in *M. warreni* than in *M. marmota.*

Cynomys leucurus Merriam.

Between Meeker and Axial, Colorado (*A. H. Felger*).

Malleus. Head large, rising in a rounded eminence well above the articular surface, but somewhat flattened laterally; articular surface double and deeply cut. Manubrium thick anteriorly and thin posteriorly, the end feebly spatulate, with a well-developed processus muscularis near the middle of the side. Very distinct from *Marmota* by the form of the head and manubrium.

Incus. Body subquadrate, with a wide but shallow articular surface; processus brevis massive, pointed; stapedial process not very long, broadening at end, but without a sylvian apophysis.

Stapes. Similar to that of *Citellus grammurus* in most respects, but (at least in *C. gunnisoni*) the foot-plate is quite flat, and there is no stapedial process. There is a bony intercrural canal.

Cynomys gunnisoni (Baird).

Florissant, Colorado (*T. D. A. Cockerell*).

In a specimen examined, the ossicles were slighter, and the stapedial process of the incus noticeably more slender. This may be due to immaturity. Some years ago the senior author borrowed Mr. E. R. Warren's collection of *Cynomys* skulls, to determine whether any specific characters could be found which could be recognized in semifossil specimens. He found some rather conspicuous differences in the skulls, but they appeared to represent individual variations, and he was quite unable to detect definite cranial characters to separate *C. gunnisoni*, *C. leucurus* and *C. ludovicianus*. According to Baird's figure, the accessory palatine foramina are mesad of the last molars (instead of caudad of them) in *C. gunnisoni*, but this appears to be an error. An apparently fossil specimen from the Arroyo Pecos, Las Vegas, New Mexico (*M. Benedict*), appeared to differ from *C. ludovicianus* by having the nasals about 22 mm. long in a skull 61 mm. long (20 mm. in skull 62 mm. in *ludovicianus*); least breadth of palate 5 (instead of 6) mm.; parietals narrower, not over 7 mm. broad at middle (instead of 8); but the study of a series of *ludovicianus* showed that these were not valid characters. The living species are nevertheless quite distinct on characters of pelage, and thus we find that in dealing with fossils we should be equally in danger of confusing different species, and of distinguishing supposed species on fallacious characters.

Citellus grammurus (Say).

Howard's Ranch, near Sugar Loaf, Colorado (*Frank Goddard*).

Malleus. Head wider and less elongated than in *Sciurus fremonti;* articular surface deeply cut; a ridge extends downwards from the articular area and terminates in a projection on the neck; manubrium long, flattened, spatulate apically, with a sharp processus muscularis (for the tensor tympani) near the middle; near the margin of the manubrium, on the opposite side from the processus muscularis, is an elongated groove, apparently representing the thin area which occupies the whole of the middle of the manubrium in various other rodents.

Incus. Body subquadrate; articular surface double, but one of the surfaces is divided by a ridge; processus brevis rather short, stout, pointed; stapedial process stout, with a lateral bony lamina; no sylvian apophysis.

Stapes. Large, with very long but stout crura, both slightly curved; stapedial process very prominent. A prominent bony intercrural canal.

Citellus elegans (Kennicott).

Near Buford, Colorado (*A. H. Felger*).

The ossicles are almost identical in size and form with those of *C. grammurus.* The ossicles of the European *Citellus citellus* (L.) are figured by Doran, who says that the malleus is in general like that of *Sciurus vulgaris,* but has a more distinct trace of a processus brevis; while the incus is of the *Tamias* form. Doran's figure of the malleus represents that ossicle in a position not shown in our figures; but when the malleus of *C. grammurus* is placed so as to give the same view as Doran's figure, it appears that the processus cephalicus and attending lamina in our animal are much longer, and the processus muscularis is much further down the side of the manubrium. The incus of *C. grammurus,* compared with Doran's figure, has the stapedial process much stouter distally. It is to be remarked that *C. citellus* belongs to typical *Citellus,* whereas *C. grammurus* is the type of *Otospermophilus* Brandt, regarded by Mearns as a distinct genus. The two do not differ greatly in cranial or dental characters, but the interorbital breadth of *C. grammurus* is much greater than in the European animal. *C. elegans,* which does not belong to *Otospermophilus,* has ossicles like those of *grammurus.*

Eutamias operarius (Merriam).

Boulder Cañon, Colorado (*Miller and Printz*).

Malleus. The most delicate of the Sciuridæ examined; articular surface deeply cut; processus cephalicus, as in *Citellus grammurus,* becoming thin and fragile distally; a small projection below the articular surface, as in *C. grammurus;* manubrium slender, broadly spatulate apically.

Incus. Formed practically as in *Sciurus fremonti,* with a long stapedial process.

Stapes. Rather small, with a very well developed stapedial process.

E. quadrivittatus (Say) presented no difference in the ossicles worthy of note.

Callospermophilus lateralis (Say).

Marvine Lodge, Rio Blanco Co., Colorado (*A. H. Felger*).

Malleus. Much more like that of *Sciurus* than *Eutamias;* head long, elevated apically; manubrium long and thin, spatulate apically.

Incus. Considerably smaller than in *Sciurus* or *Citellus grammurus.* No sylvian apophysis.

Stapes. Smaller than in *Sciurus* or *Citellus grammurus;* stapedial process rudimentary. A well-developed bony intercrural canal.

Sciurus fremonti Audubon and Bachman.

North Boulder Creek, Colorado (*F. W. Rohwer*).

Malleus. Head comparatively long and narrow; manubrium spatulate apically.

Incus. Processus brevis rather more slender than in *Callospermophilus;* stapedial process long, sharply bent at the end.

Stapes. Larger and heavier than in *Callospermophilus.*

Doran has described the ossicles of *Sciurus* at considerable length, and figures those of *S. maximus.* His figure of the malleus looks much more like ours of *Eutamias* than *Sciurus;* but on examining a series of *S. fremonti* and *S. aberti* (which does not materially differ in the ossicles) we find that the thin laminar continuation of the processus cephalicus (as in *Eutamias* and *Otospermophilus*) is much elongated in good specimens, even more than in Doran's figure. The general conclusion is that the ossicles of *Sciurus,* sens. lat., are very uniform in type.

The Sciuridæ in general are distinguished by the character of the manubrium, which is a solid structure, instead of being thin with a thickened margin, as in other groups.

Among the Sciurid genera we have studied, *Marmota* stands entirely apart by the high curved crest-like pointed process on the head of the malleus. The ossicles of all the other genera are so much alike that it seems impracticable to construct a satisfactory key for their separation. In the classification given in Osborn's 'Age of Mammals,' the family Sciuridæ is divided into five subfamilies, of which the Sciurinæ contain *Sciurus* and *Tamias,* while the Arctomyinæ consist of *Palæarctomys, Spermophilus* (*Citellus*), *Arctomys* (*Marmota*) and *Cynomys.* However, judging from the ear bones, and also from the cranial characters (cf. the parallel rows of molariform teeth, the flattened dorsal surface of the skull, the structure of the posterior part of the mandible in *Marmota*) the marmots constitute a valid subfamily MARMOTINÆ (Arctomyinæ), while the genera *Cynomys* and *Citellus* are Sciurine. The fossil *Palæarctomys* evidently belongs to Marmotinæ, although the molars distinctly converge posteriorly.

CASTORIDÆ.

Castor canadensis Kuhl. History unknown.

Malleus. Head large, obtusely rounded above, the apex well above the articular surface; articular surface very wide; cephalic process rudimentary; manubrium slender, curved, very strongly bimarginate, very little expanded apically. The difference between our figures and Doran's of the European beaver are partly due to the position of the ossicle, but the head in ours is certainly more rounded, less angular, and the plane of the manubrium appears to be different.

Incus. Robust, with a large body, a small pointed processus brevis, and a large, thick stapedial process, having a sort of spiral twist near the end.

The stapes of *Castor* is well figured and described by Doran. He states that there is no bony intercrural canal, such as exists in the Sciuridæ.

The Castoridæ are at once distinguished from the Sciuridæ by the strongly bimarginate manubrium.

HETEROMYIDÆ.

Perognathus penicillatus Woodhouse.

Fort Mohave, Arizona (*J. Henderson*).

The bullæ are little inflated, but in the dry skull the whole region of the ear appears chalky white, the wall of the middle ear being composed of cancellous bone, of which there is a rather thin layer below, but a very thick one above. The inner posterior cells of this cancellous area are very large, but the others are small. The cancellous bone is finer (with smaller cells) than in *Ochotona,* and does not reach the cochlea on both sides as it does in that genus; in fact the open cavity beneath the cochlea is very large.

Malleus. The malleus and incus are firmly attached together, the junction being marked by a line which is scarcely impressed. Head large and obtusely rounded, well elevated above the articular surface; no processus cephalicus, but a delicate and short processus gracilis, bounding a rather small lamina; manubrium dagger-shaped, bimarginate, with a minute angular processus brevis and a basal processus muscularis.

Incus. Body large and rounded, the processes diverging at right angles; processus brevis fully two-thirds length of stapedial process. No sylvian apophysis.

Stapes. Ordinary in form, except that the foot plate is strongly convex and bullate below, approaching the condition of the Geomyidæ. There is no stapedial process. There is a very delicate, slightly ossified intercrural canal.

Perodipus montanus (Baird).

Hooper, Colorado (*E. R. Warren*).

The tympanic cavity is greatly inflated, and its upper part is divided by thin vertical walls, suggestive of the mesenteries of an actinian. The

number of these walls varies on each side from about 8 to 11. This condition is very different from that of *Perognathus,* though there are some points of similarity. The various cranial and dental differences, together with the peculiar auditory ossicles (especially the incus), almost suggest the propriety of raising the Dipodomyinæ to family rank.

Malleus. Relatively large; head not elevated above the articular surface to any great extent, but broad and rounded above; articular surface deep, strongly margined; cephalic process not developed, but the stout processus gracilis bounds a well-defined lamina; manubrium very thin, bimarginate. In our figure the manubrium appears narrower than it actually is, because the ossicle was placed in such a position as to exhibit the processus gracilis above.

Incus. A very remarkable bone, saddle-shaped above, with a long body and relatively short processes. There is no sylvian apophysis.

Stapes. Rather narrow, with a large wide head; crura not strongly divergent; foot plate strongly bullate, though not nearly so much so as in *Thomomys.*

GEOMYIDÆ.

Thomomys clusius Coues.

East of Boulder, Colorado (*Norman de Witt Betts*).

Malleus. Head not very broad, scarcely at all elevated above the articular surface; processus cephalicus angular; no distinct processus gracilis; manubrium bimarginate, its outer side broadened, subspatulate apically; processus brevis a distinct angular projection.

Incus. Elongate, with a broad but rather short processus brevis, and a long stapedial process, which is bifurcate at the end. There is no sylvian apophysis.

Stapes. With an enormous bullate foot-plate as shown in the figure. There is an intercrural canal, as shown in one of our figures.

Doran figures and describes the ossicles of *Geomys bursarius* (Shaw). He says of the stapes: "On its base there projects toward the vestibule a very large bulla, better developed than in *Mustela* or *Hyrax,* and rivalling the same condition already described by Hyrtl as existing in *Phalangista cookii.*" This bulla, as shown by Doran's figure, is about as in *Perodipus,* and not nearly so extreme as that of *Thomomys.* In *Phalangista cookii,* however, the bulla is fully as convex as in *Thomomys.* The incus of *Thomomys* is not at all like that of *Perodipus* or *Perognathus,* and judging from Doran's figure is not much like that of *Geomys.* The malleus of *Thomomys* is rather suggestive of that of the rabbit.

ZAPODIDÆ.

Zapus princeps Allen.

Five miles east of Boulder, Colorado (*D. M. Andrews*).

Malleus. A large more or less discoid body above the manubrium, from which arises the slender arched cephalic peduncle, and also a rather short processus gracilis, which enters the middle of the broad lamina; at the base of the processus gracilis is a well developed processus muscularis, shaped like the end of a finger, standing out almost at right angles to it (this is not shown in our figure, being on the wrong side); the head is relatively slight, with a small articular surface, and the well developed processus cephalicus is directed downwards, bounding the lamina; manubrium dagger-shaped, bimarginate, the margin seen from without broad but extremely thin, the inner margin slender.

Incus. Very small, with a short low-conical processus brevis, and a longer stapedial process. There appears to be a small sylvian apophysis.

Stapes. Crura subparallel, one of them strongly angular above on the outer side, for the insertion of the stapedius muscle; foot-plate convex.

There is a delicate intercrural canal. There is a curious general resemblance between the malleus of *Zapus* and that of *Plecotus*, as figured by Doran. The large rounded and compressed swelling above the base of the manubrium, well shown in our figure, can only be regarded as an orbicular apophysis, although its form is peculiar.

OCTODONTIDÆ.

Proechimys semispinosus (Tomes).

Colombia (*Leo. E. Miller;* A. M. N. H.).

The malleus and incus were found to be separable.

Malleus. Head transversely elongated, rounded, of the same general type as that of *Dasyprocta, Aulacodus, Capromys, Chinchilla* and *Dolichotis;* manubrium bimarginate, dagger-like, the outer border broadened and spatulate, the heel or processus brevis well developed.

Incus. The two processes subequal, the stapedial one thick, the other tapering.

Stapes. Triangular, with a high head and very broad base. There is a delicate bony intercrural canal.

Doran figures and describes the ossicles in an *Octodon cumingii* six weeks old. The figures represent the ossicles as curiously different from the rest of the Hystricomorpha (which are otherwise, on the whole, surprisingly uniform in general type), and we are led to wonder whether this is due to the youth of the animal, or is normal for *Octodon;* or whether, possibly, there is some error in identification. The ossicles figured strike one as being very Sciurine in type.

DASYPROCTIDÆ.

Dasyprocta sp.

Central Park Menagerie, New York; ♀ (in captivity). (A. M. N. H., 23082.) The malleus and incus could not be separated.

Malleus. Head transversely elongated, flattened above, rounded at the abincal end; from beneath, the rounded extension of the head appears subtriangular, with a deep pit on the under side, below which is the rudimentary but stout processus gracilis; manubrium broad and short, bimarginate.

Incus. Head rather long; processus brevis conical, stout; stapedial process longer, curved at the end, with a small button-like sylvian apophysis, without a narrowed peduncle.

We were unable to study the stapes, but it is figured by Doran. It is entirely of the same type as that of *Proechimys.*

CAVIIDÆ.

Cavia; Domesticated Guinea-Pig.

Bloomington, Indiana (*Max M. Ellis*).

The incus could not be separated from the malleus.

Malleus. Head transversely elongated, flattened above, the abincal extremity variably lobulated; processus gracilis scarcely indicated; manubrium a short stout triangular process of bone, variably bifid at end, and with an extremely large processus brevis. The actual size of the combined malleus and incus is hardly less than that of *Dasyprocta,* although the skull of the latter is so very much larger.

Incus. Very much as in *Dasyprocta;* stapedial process longest.

Stapes. Large in proportion; crura thick; base broad; stapedial process short and obtuse. There is considerable variation, as shown in our figures. We found no intercrural canal; Doran states that one is sometimes present.

Cavia, though so familiar, is really a remarkable animal, with cranial characters very distinct from those of *Dasyprocta,* etc. The auditory ossicles seem to be very variable, and no doubt the whole animal, as it exists in a domesticated state, is in a condition of instability.

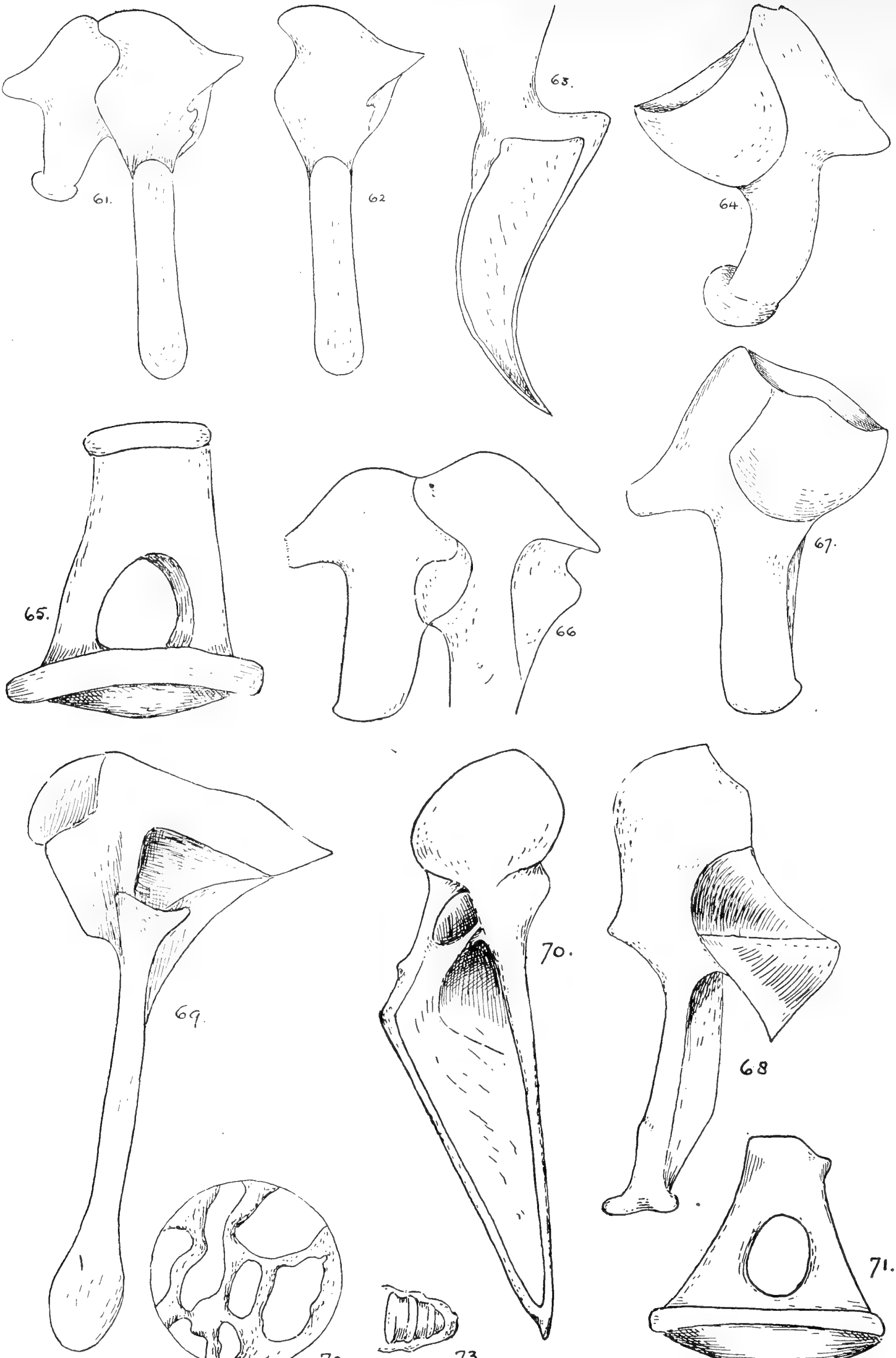

Fig. 61. *Oryctolagus cuniculus.* Malleus and Incus.
Fig. 62. *Oryctolagus cuniculus.* Malleus of another specimen.
Fig. 63. *Oryctolagus cuniculus.* Manubrium.
Fig. 64. *Oryctolagus cuniculus.* Incus.
Fig. 65. *Oryctolagus cuniculus.* Stapes.
Fig. 66. *Sylvilagus auduboni minor.* Malleus and Incus.
Fig. 67. *Sylvilagus auduboni minor.* Incus.
Fig. 68. *Ochotona saxatilis figginsi.* Incus.
Fig. 69. *Ochotona saxatilis figginsi.* Malleus.
Fig. 70. *Ochotona saxatilis figginsi.* Malleus, showing manubrium.
Fig. 71. *Ochotona saxatilis figginsi.* Stapes.
Fig. 72. *Ochotona saxatilis figginsi.* Portion of tympanic wall, much magnified.
Fig. 73. *Ochotona saxatilis figginsi.* Cochlea.

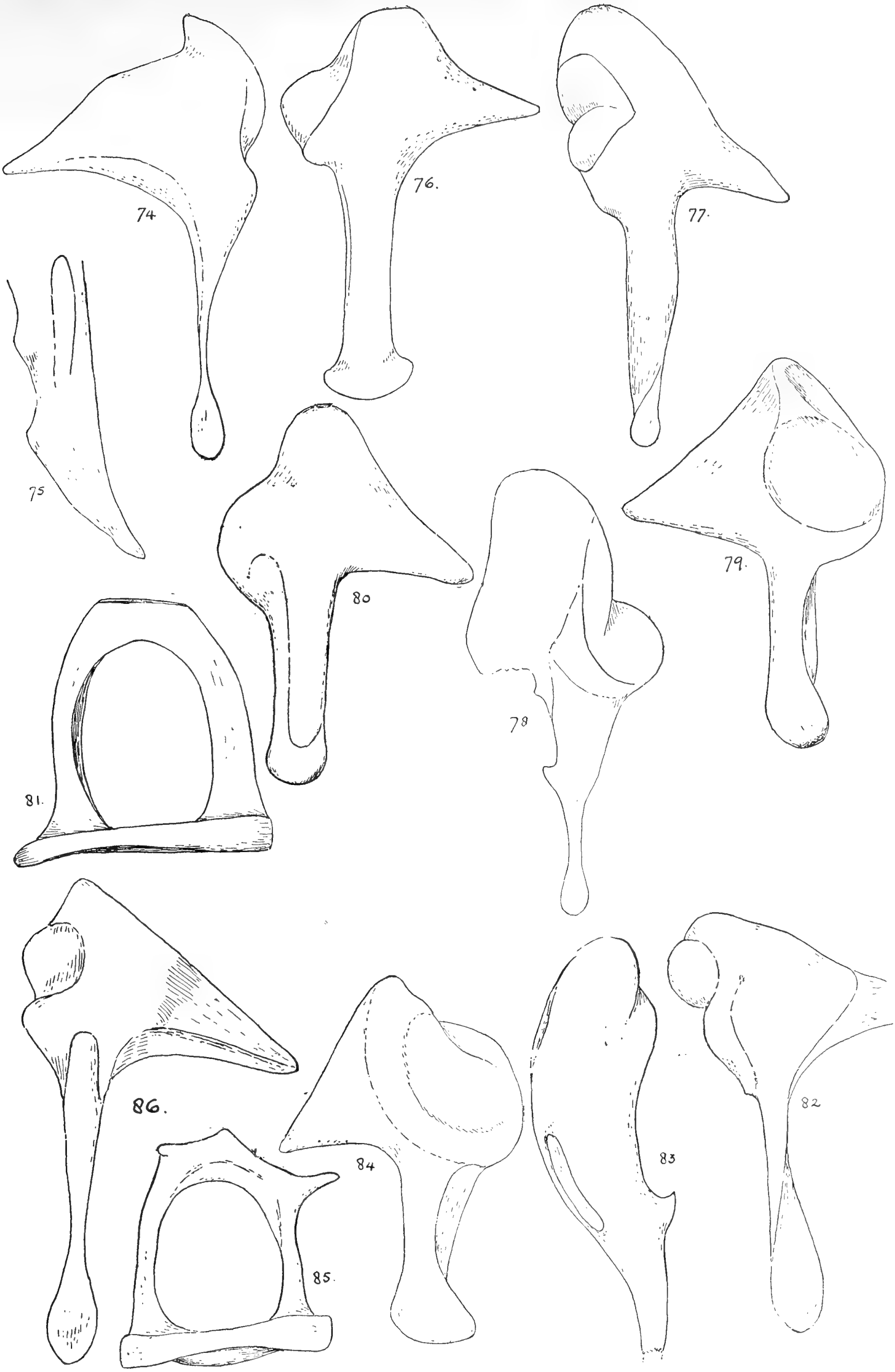

Fig. 74. *Marmota flaviventer warreni.* Malleus.
Fig. 75. *Marmota flaviventer warreni.* Manubrium.
Fig. 76. *Marmota flaviventer warreni.* Incus.
Fig. 77. *Cynomys leucurus.* Malleus.
Fig. 78. *Cynomys leucurus.* Malleus.
Fig. 79. *Cynomys leucurus.* Incus.
Fig. 80. *Cynomys leucurus.* Incus.
Fig. 81. *Cynomys gunnisoni.* Stapes.
Fig. 82. *Citellus grammurus.* Malleus.
Fig. 83. *Citellus grammurus.* Malleus, showing manubrium. The foreshortened processus cephalicus and adjacent parts are not shown.
Fig. 84. *Citellus grammurus.* Incus.
Fig. 85. *Citellus grammurus.* Stapes.
Fig. 86. *Eutamias operarius.* Malleus.

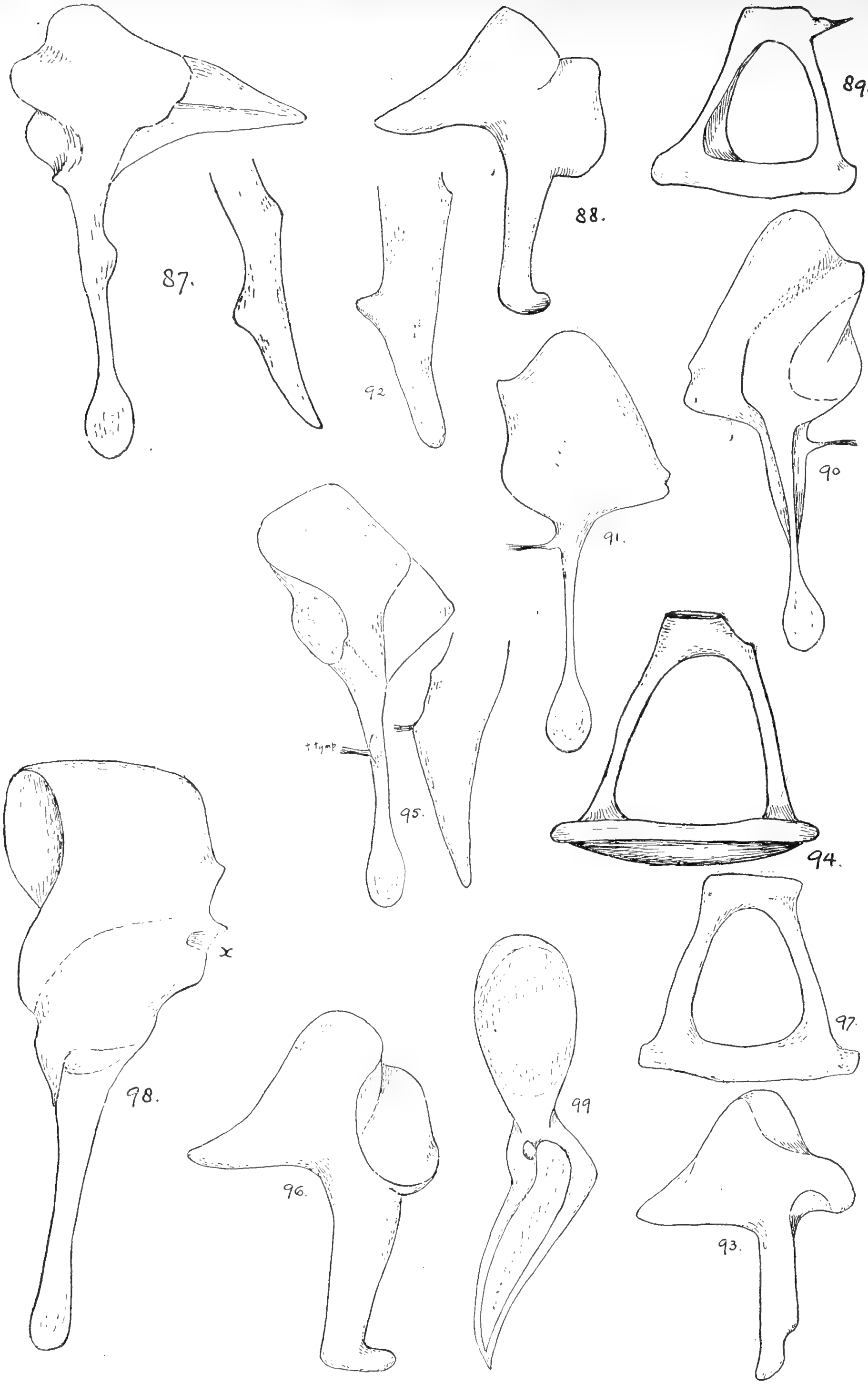

Fig. 87. *Eutamias operarius.* Malleus, and side view of manubrium.
Fig. 88. *Eutamias operarius.* Incus.
Fig. 89. *Eutamias operarius.* Stapes.
Fig. 90. *Callospermophilus lateralis.* Malleus.
Fig. 91. *Callospermophilus lateralis.* Malleus.
Fig. 92. *Callospermophilus lateralis.* Manubrium.
Fig. 93. *Callospermophilus lateralis.* Incus.
Fig. 94. *Callospermophilus lateralis.* Stapes.
Fig. 95. *Sciurus fremonti.* Malleus, and side view of manubrium.
Fig. 96. *Sciurus fremonti.* Incus.
Fig. 97. *Sciurus fremonti.* Stapes.
Fig. 98. *Castor canadensis.* Malleus. At place marked x, injured by Anthrenus.
Fig. 99. *Castor canadensis.* Malleus, showing manubrium.

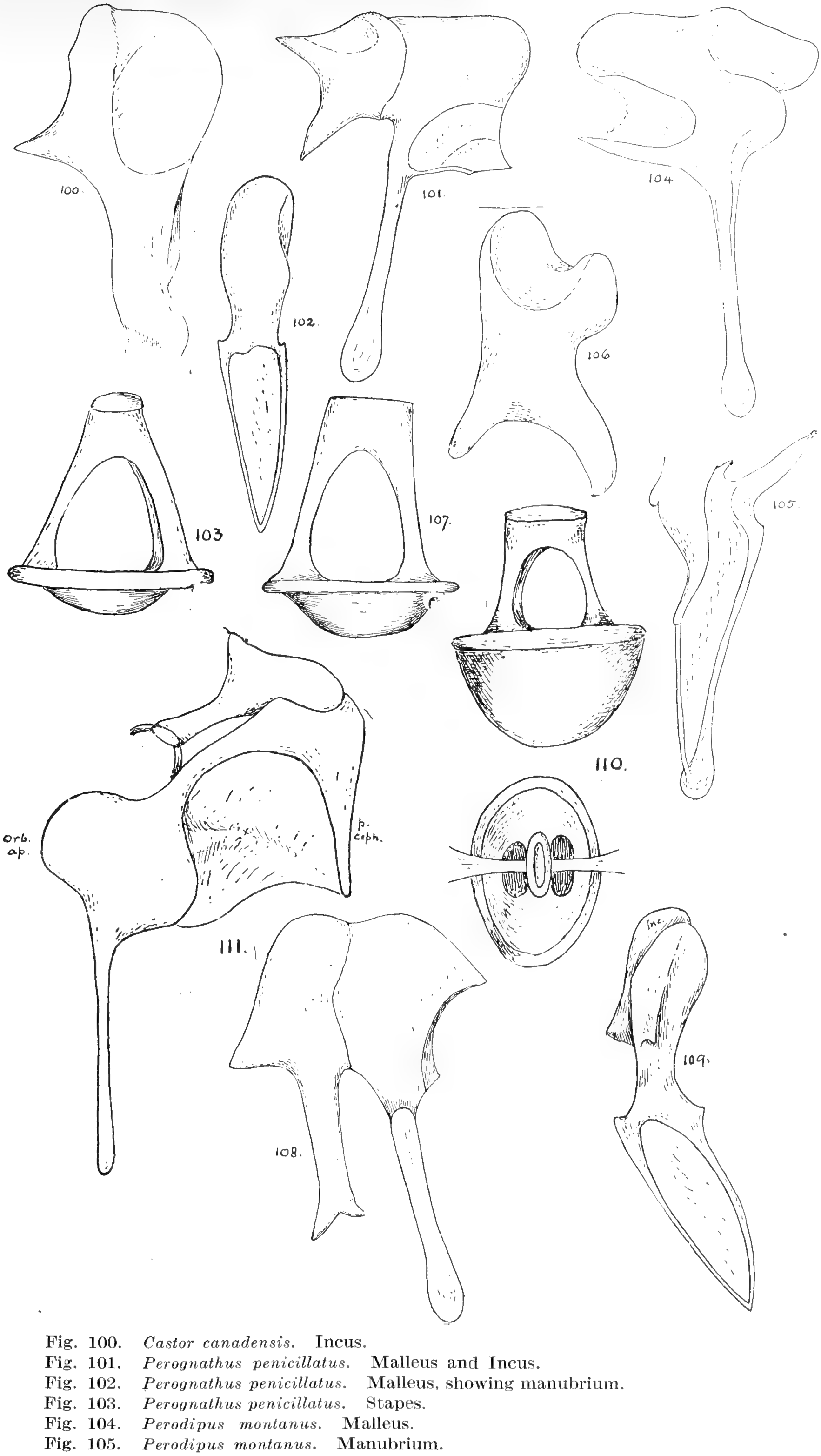

Fig. 100. *Castor canadensis.* Incus.
Fig. 101. *Perognathus penicillatus.* Malleus and Incus.
Fig. 102. *Perognathus penicillatus.* Malleus, showing manubrium.
Fig. 103. *Perognathus penicillatus.* Stapes.
Fig. 104. *Perodipus montanus.* Malleus.
Fig. 105. *Perodipus montanus.* Manubrium.
Fig. 106. *Perodipus montanus.* Incus.
Fig. 107. *Perodipus montanus.* Stapes.
Fig. 108. *Thomomys clusius.* Malleus and Incus.
Fig. 109. *Thomomys clusius.* Melleus, showing manubrium.
Fig. 110. *Thomomys clusius.* Stapes, views from side and above.
Fig. 111. *Zapus princeps.* Malleus and Incus.

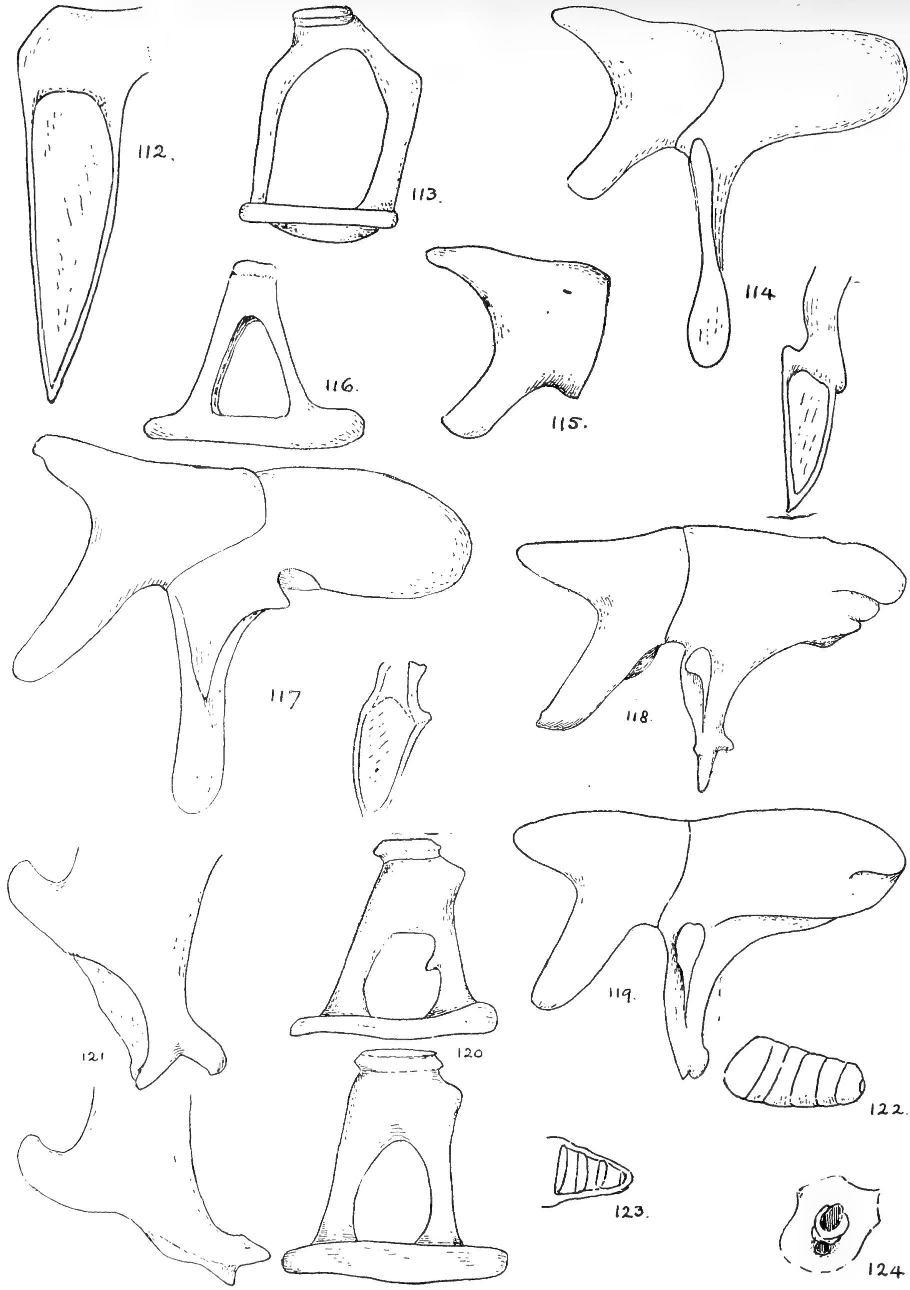

Fig. 112. *Zapus princeps.* Manubrium.
Fig. 113. *Zapus princeps.* Stapes.
Fig. 114. *Proechimys semispinosus.* Malleus and Incus, and side view of manubrium.
Fig. 115. *Proechimys semispinosus.* Incus.
Fig. 116. *Proechimys semispinosus.* Stapes.
Fig. 117. *Dasyprocta.* Malleus and Incus, and side view of manubrium.
Fig. 118. *Cavia.* Malleus and Incus.
Fig. 119. *Cavia.* Malleus and Incus, showing variation.
Fig. 120. *Cavia.* Stapes, showing variation.
Fig. 121. *Cavia.* Manubrium, showing variation.
Fig. 122. *Cavia.* Cochlea, from without.
Fig. 123. *Cavia.* Cochlea, section.
Fig. 124. *Cavia.* Double external auditory meatus. In *Dasyprocta* the lower orifice is very small, and is connected with the large upper one. In *Proechimys* there is a minute foramen below the large meatus, separated from it but emerging through a groove on its lower inner face. This foramen or incision appears to represent the auricular fissure, for the auricular branch of the pneumogastric nerve; but it is not readily apparent why there should be a large orifice, leading into the tympanum, in *Cavia*.

1–5. DACLYTOMYS DACTYLINUS.
6–10, THRINACODUS APOLINARI.

APPENDIX.[1]

The characters of the auditory ossicles may supply taxonomic evidence of the greatest importance, especially in so puzzling a group as the Rodents. They would supply an independent series of differentiations to act as a check on the differentiations of teeth skull and skeleton. They may afford the clue to unravel some of the puzzles which parallelism and convergence have brought about in the systematic position and relations of different groups.

Nevertheless, I think their evidence should be used with great caution, and rather to discover clues and confirm other evidence than as an independent basis of taxonomy. The reason for such caution is this:

(1) The great difficulty in classifying rodents by osteologic and dental characters lies in the frequent parallelism and convergence in these characters. To some extent the adaptive value and correlation of these characters can be seen and interpreted. So far as this is possible, we can determine whether characters are to be interpreted as due to similar adaptation or to fundamental relationship. This is our guide for the solution of problems and harmonizing of conflicting evidence.

(2) I cannot question that the characters and evolution of the ear-bones are subject to parallelism and convergence quite as much as the more obvious mechanism of the teeth and skeleton parts. But the adaptive relationship is so obscure and recondite that the mechanical reasons for their form are not apparent. Whether the resemblances in the ear-bones of two rodents are controlled by heredity or by similar adaptation (similar as respects the parts concerned) we cannot tell. Until we know the significance of the resemblances and differences we have no way of using them as a secure basis of classification; we have to solve the apparently conflicting evidence by arbitrary assumptions that one feature is due to parallelism, another to affinity.

This same criticism holds true with regard to other characters of more or less obscure relation to the adaptive environment, when used in classification. The use of the genitalia, of brain or other characters of soft anatomy has been advocated as of fundamental value in taxonomy because, it is said, they are not in direct contact with the environment and hence less subject or not at all subject to the deceptive results of parallelism. I do not think this is true at all. Every character of an animal as I see it is a product of its heredity and environment; every character is moulded by the adaptation. The characters of the soft anatomy are often controlled by a different set of adaptive circumstances, altered by circumstances that do not affect the osteology, or left unchanged by others that do. For that reason they are of great taxonomic value, as they often show clearly relationships that have been obscured or hidden in the osteology by adaptive divergences, or primary divergences that have been concealed by convergent evolution in the osteology. But they are more apt to lead us astray because we cannot so readily interpret their adaptive value. Resemblances due to parallelism are not so obviously superficial. It is not so easy to see what the primitive conditions must have been. And, above all, we lack the

[1] In response to request from the authors, for comment and criticism of the foregoing paper, the following comment and suggestions have been offered by Dr. Matthew and Dr. Gregory.— Editor.

evidence of palæontology to show us beyond question what the primitive conditions in each group actually were, and what the historic facts are as to the course of its evolution.

This last is an incurable defect. Where we cannot check our inferences and interpretations by their correspondence with the facts of the geologic record, their taxonomic evidence cannot be of equal weight with evidence that is so supported. It may be of great supplementary value indeed. But if used as fundamental it is very apt to be misleading. Instance Tullberg's monograph of the Rodents, a treatise beyond criticism as to thoroughness and method of handling the anatomical evidence. But having no sufficient data as to the fossil rodents, he is entirely astray in his conclusions as to their phylogeny and consequently as to their taxonomy. The later discoveries of skulls and skeletons of Eocene and Oligocene rodents show that the primary type was not *Bathyergus* as he supposed, and that the Hystricomorphs are a specialized, not a primitive group.

I do not mean to minimize the importance of this class of characters in taxonomic work, but only to emphasize the need for caution in their use.—W. D. Matthew.

In response to the request of the authors for "comment or criticism" I can only call attention to a few of the problems and conclusions which their admirable studies offer for further development.

(1) The resemblances of the ossicles of the Myomorpha to those of the Shrews and other Insectivores, in relation to the origin of the Rodents.

(2) The taxonomic value of the ossicles in the Arvicolidæ, Muridæ, Sciuridæ, Hystricomorpha etc.

(3) Are the Heteromyidæ related to the Geomyidæ?

(4) Are the Zapodidæ Myomorpha?

(5) Are the Lagomorpha an entirely distinct order (Gidley) or do their ossicles connect them with other rodents?

(6) Do highly specialized life habits (as in the Spalacidæ, Pedetidæ, *Sciuropterus*) have any clearly discernible relation to the form of the ossicles?

W. K. G.

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Article XXIX.— NEW SOUTH AMERICAN BATS AND A NEW OCTODONT.

BY J. A. ALLEN.

PLATE XXVIII.

In determining the bats recently collected in northern South America by recent American Museum expeditions the following forms have been discovered in the American Museum collections which appear to be undescribed.

I am indebted to Mr. Wilfred H. Osgood, of the Field Museum of Natural History, for the loan of specimens of *Amorphochilus,* and to Mr. Gerritt S. Miller, Jr., of the United States National Museum, for valued assistance in a preliminary examination of most of the material here described, through direct comparison with the National Museum collection.

Amorphochilus schnablii osgoodi subsp. nov.

Amorphochilus schnablii OSGOOD (not of Peters), Field Mus. Nat. Hist., Zool., X, No. 12, p. 180, April 20, 1914.

Type, No. 19684, Field Mus. Nat. Hist., ♂ ad., Hacienda Limon (altitude 3000 ft.), near Balsas, Peru; Wilfred H. Osgood and M. P. Anderson.

Similar in size and general features to *A. schnablii* but coloration much lighter throughout. Upperparts dark smoke gray, instead of deep mouse gray washed with blackish ("dunkelbraun," Peters) as in *schnablii;* a slight buffy suffusion over the top and front of the head, as in *schnablii;* underparts slightly paler than the back. External measurements and proportions nearly as in *schnablii.* Skull measurements practically the same, but braincase less inflated.

Based on two specimens, a type (♂ skin) and a topotype (♀ in alcohol), already fully described by Osgood (*l. c.*).

Three specimens in the American Museum from Puna Island, Ecuador, are practically topotypes of *schnablii,* which was based on a specimen from Tumbez, Peru, in the arid coast belt less than 50 miles south of Puna Island. The Puna Island specimens have a strong blackish wash, both above and below, in contrast with the drab tinge in the Balsas specimens, from the humid interior east of the main Andean chain in northern Peru.

I am greatly indebted to Mr. Osgood for kindly placing his specimens at my disposal in the present connection.

As Peters's description of *A. schnablii*[1] is not very detailed in respect to coloration and measurements, the following description of the Puna Island specimens is submitted:

Upperparts deep mouse gray (Ridgway), the tips of the hairs blackish; front and top of head with a pale buffy suffusion; underparts nearly of the same color as the upper; ears light brown; membranes a little darker than the ears. Forearm (♂ ad.), 35; third metacarpal, 34; third finger, 58; tibia, 15.5; foot, 6.5; calcaneum, 11. Skull, total length, 12; length of braincase, 7.5; breadth of braincase, 6; length of upper toothrow (with canine), 5; breadth of palate from outside to outside of m^3, 5.

Eptesicus andinus sp. nov.

Type, No. 33807, ♂ ad., Valle de las Papas (alt. 10,000 ft.), Central Andes, Huila, Colombia, March 26, 1912; Arthur A. Allen and Leo E. Miller.

Similar in coloration to *E. fuscus miradorensis* (H. Allen) but much smaller (compared only with Chiriqui, Panama, specimens). Skull (in volume) less than half the size of the skull of *miradorensis*. Coloration above as in *E. hilarii* (I. Geoffroy), but very much darker on underparts (in comparison with specimens from Rio Yuruan, Venezuela).

Upperparts (type) uniform dark seal brown, the extreme tips of the hairs slightly lighter than the basal portion; underparts dark wood brown, slightly lighter posteriorly; ears and membranes blackish. Collector's measurements: Expanse, 300; head and body, 65; tail, 35; hind foot, 8. Forearm (in skin), 42.5; third metacarpal, 40; tibia, 18; foot, 8; calcaneum, 11. Another specimen from Almaguer (a nearby locality, alt. 10,300 ft.), is similar in coloration and measurements, as is a specimen from El Roble (alt. 7200 ft., Central Andes), also referred to this species.

Skull (type), total length, 16.5; zygomatic breadth, 10; breadth of braincase, 8; interorbital breadth, 4.3; upper toothrow (including canine), 6.

In size this species agrees closely with *E. propinquus* and *E. hilarii*, but the coloration is very much darker, especially below. It is larger than *E. dorianus* and differs from it in color of ventral surface.

A specimen (skin without skull) from Fusugasuga (alt. 6000 ft.), near Bogotá, is similar in size but the coloration above has a reddish tone (about walnut brown) and the underparts are deeper yellowish brown (about ochraceous tawny of Ridgway, 1912).

Dasypterus ega punensis subsp. nov.

Type, No. 36271, ♀ ad., Puna Island, Ecuador, April 3, 1913; W. B. Richardson.

Similar to *D. ega fuscatus* but more heavily washed with black, both above and below. Upperparts (type) grayish pale buff with the tips of the hairs black, the

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[1] Monatsber. K. Pr. Akad. Wiss. Berlin, 1877, p. 185.

black forming, in some specimens, the predominant tone; face blackish; upper surface of interfemoral membrane like the back; throat and breast blackish brown; abdomen and anal region pale buffy gray, much paler than the upperparts.

Forearm (type), 45. Forearm, 5 specimens (type and 4 topotypes), 46.5 (45–49).

Skull (type), greatest length, 16; zygomatic breadth, 11; interorbital breadth, 5: upper toothrow (including canine), 5.5.

Nearest related to *D. ega fuscatus* but general coloration much paler; black tips of the hairs of the dorsal pelage longer and more predominant over the ground color, face darker and foreneck and chest distinctly blackish brown in contrast with the pale abdominal area. Doubtless peculiar to Puna Island and the adjacent arid coast district of Ecuador and Peru. Represented by five specimens, all from Puna Island, with which a topotype of *D. ega fuscatus* is available for comparison.

Myotis ruber keaysi subsp. nov.

Type, No. 15814, ♂ ad., Inca Mines (altitude 6000 feet), Peru (lat. 13° 30′ S., long. 70° W.), Dec. 2, 1899. Coll. H. H. Keays, for whom the form is named.

Upperparts auburn, the basal half of the hairs darker; underparts Saccardo's umber (Ridgway), becoming abruptly buff yellow on the lower abdomen and basal third of interfemoral membrane; ears and membranes nearly black. Cranial characters and dentition as in typical *Myotis;* pelage short and thick; basal third of interfemoral membrane hairy on both surfaces.

Collector's measurements: Extent, 266; head and body, 49; tail, 40. Forearm (in skin), 39; third metacarpal, 35; third finger, 62; tibia, 16; foot, 7.2. Skull (imperfect, lacking the occipital portion), total length, —; interorbital breadth, 3.3; breadth of braincase, 6.2; upper toothrow (with canine), 5; breadth of rostrum at canines, 3.5; breadth of palate from outside to outside of m^3, 5.3.

Resembles *M. ruber ruber* (Geoffroy) of Paraguay in size and other general features,[1] but with longer pelage and darker and less rufescent coloration above, with the lower abdomen and ventral surface of the interfemoral membrane much paler.

Myotis punensis sp. nov.

Type, No. 36263, adult (♂?), Puna Island, Ecuador, April 8, 1913; W. B. Richardson.

Similar in coloration to *Myotis albescens* (Geoffroy) and *M. oxyotus* (Peters) but very much smaller. Upperparts light mouse gray, the tips of the hairs pale grayish olivaceous; underparts, surface color pale grayish white with a slight buffy tinge; ears and membranes dusky brown or fuscous.

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[1] *Cf.* Thomas, Ann. and Mag. Nat. Hist. (7), X, p. 493, Dec. 1902.

Forearm, 32; third metacarpal, 29; third finger, 52; tibia, 13; foot, 6; calcaneum, 10. Skull, total length, 13; zygomatic breadth, 8; breadth of braincase, 6.4; interorbital breadth, 3.6; upper toothrow (including canine), 4.8. The skull has a high, rounded braincase, rising abruptly from the base of the rostrum.

A topotype is similar in coloration but smaller, being a young adult. One other specimen from Daule, Ecuador, and two from Barbacoas, Colombia, are provisionally referred to this species. They agree with the type in size, color and cranial characters, but are slightly more buffy below, and may prove subspecifically separable from the insular type form from arid Puna Island, on the basis of coloration.

The difference in size and the markedly different form of the skull in *M. punensis* readily distinguish it from either *M. oxyotus* or *M. albescens,* in which the forearm has a length respectively of 36–40 and 43 mm. as compared with 32 in *punensis,* and in the braincase rising abruptly instead of gently from the rostrum.

Myotis bondæ sp. nov.

Type, No. 14587, adult, Bonda, Santa Marta, Colombia, June, 1898; coll. H. H. Smith.

Upperparts sepia brown; underparts drab washed with pale buff; ears and membranes dark brown. Forearm (type, skin), 32.6; third metacarpal, 30; third finger, 56; ear, 6; tibia, 13; foot, 7; calcaneum, 11. The forearm in 11 adult topotypes averages 33 (32–34).

Skull, total length (type), 13; breadth of braincase, 6.2; average of 4 topotypes, total length, 13.2 (13–13.5); breadth of braincase, 6.2 (all 6.2).

Represented by 25 specimens, all taken at Bonda, but only about 12 are fully adult, while four or five are less than half grown. The adults are very uniform in coloration; the immature specimens are darker.

It has been suggested that the name *Vespertilio concinnus* H. Allen (1886), based on two alcoholic specimens from Salvador, Central America, may be applicable to a small bat of the *nigricans* group " occurring in Columbia and Mexico," but there is not much evidence of its possible application to the present form.[1] *Myotis nespotus* Miller, Curaçoa Island, while of the same size as *bondæ* is very different from it in coloration.

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[1] *Cf.* Miller, Proc. Biol. Soc. Washington, XIII, p. 154, June 13, 1900. Referring to the Salvador specimens, Miller says: "Though much faded in color they are clearly referable to *Myotis nigricans* (Maximilian), or at least to a form of the species occurring in Columbia and southern Mexico. The name *concinnus* is therefore a synonym of *nigricans* unless the bat to which it was applied should eventually prove to be distinct from the true *nigricans* of Brazil, specimens of which I have not seen." Later (List of North American Land Mammals, p. 58, 1912) the name *Myotis nigricans concinnus* (H. Allen) is employed for a bat ranging "From Colombia north to extreme southern Mexico." I have as yet seen no bats from southern Mexico to which the Bonda specimens can be referred.

Osgood (Field Mus. Nat. Hist., Zool., X, p. 65, Jan. 12, 1912) has referred also a specimen from El Panarama, Venezuela, to *concinnus.*

Myotis maripensis sp. nov.

Type, No. 17069, ♀ ad., Maripa, Venezuela, Dec. 13, 1909; S. M. Klages.

Similar in size to *Myotis bondæ*, but coloration different. Upperparts Saccardo brown (Ridgway, 1912) shading toward sepia; underparts drab, tips of the hairs lighter; ears and membranes dark brown. Forearm, 33; third metacarpal, 31; third finger, 54; ear, 8; tibia, 10; foot, 6. The forearm in 15 adult topotypes averages 33 (32–34.2).

Skull (type), total length (including incisors), 13; breadth of braincase, 6.2. Total length of skull in 10 adult topotypes, 13.1 (13–13.3); breadth of braincase, 6.2 (6–6.3).

Represented by 38 specimens (skins and skulls) from Maripa, Rio Caura, Venezuela, nearly all fully adult.

Myotis maripensis is similar to *M. bondæ* in size and cranial characters, but differs from it decidedly in coloration, the upper parts being less dark and much more fulvous, and the lower parts less dark and the hair tips more extensively pale buffy, giving a very different color effect for both surfaces.

Myotis nigricans (Wied) has been employed as a 'blanket name' for the small dark brown *Myotis* bats of tropical America, with a range from southeastern Brazil to central Mexico. On bringing together for comparative study the hundred or more specimens of these bats in the American Museum, from widely distant localities, it is at once evident that quite a number of strongly marked geographic forms have heretofore been included under the name *Myotis nigricans,* forms which vary quite widely in both size and coloration. Thus the present series of about 40 specimens from the Caura River (Venezuela) are very uniform in coloration and size, and agree practically in size with another series of some 20 specimens from Bonda, Santa Marta district, Colombia, but differ constantly from them in coloration. Both of these series differ again in coloration from two other distinct phases from, respectively, the coast regions of Ecuador and Colombia, but all four phases agree essentially in size. One of these west coast forms is from the arid Puna Island district of Ecuador, described above as *Myotis punensis*; the other is from the humid coast region further north and may be called

Myotis esmeraldæ sp. nov.

Type, No. 33239, ♂ ad., Esmeraldas, Ecuador, Nov. 5, 1912; W. B. Richardson.

Similar in size to *M. bondæ* and *M. maripensis* but very different from either in coloration and cranial characters, agreeing in the latter respect with *Myotis simus* Thomas from Sarayacu, Peru.

Upperparts cinnamon brown (Ridgway, 1912); underparts similar but somewhat lighter; ears and membranes dark brownish black. Forearm (type), 34; third metacarpal, 32.5; third finger, 55; tibia, 11.5; foot, 9.

Skull, total length, 13.5; zygomatic breadth, 8.5; interorbital breadth, 3.5; breadth of braincase, 6.2; upper toothrow (with canine), 5; breadth across palate from outside to outside of m^2, 5.3. Skull with the rostrum broad and heavy, braincase low and broad, length of upper toothrow less than breadth of palatal region at m^2.

Represented, in addition to the type, by a topotype from Esmeraldas, by a single specimen from Manavi and another from Narinjo (Ecuador), and 3 from Buenavista, Noriña Dept., Colombia. The last mentioned five specimens agree in size, coloration and skull characters with the type and topotype.

Myotis caucensis sp. nov.

Type, No. 32787, ♂ ad., Rio Frio (altitude 3500 feet), Cauca River, Colombia, Nov. 29, 1911; Leo E. Miller.

Upperparts fuscous-black (Ridgway, 1912); underparts fuscous, or a little lighter than the upperparts; ears and membranes black. Collector's measurements: Expanse, 254; head and body, 81; tail, 39; foot, 8. Forearm (in skin), 37; third metacarpal, 34; third finger, 63; tibia, 15; foot, 7.5. Skull, total length, 14; zygomatic breadth, 9; interorbital breadth, 3.3; breadth of braincase, 6.2; upper toothrow (with canine), 5.2; palate, outside to outside of m^2, 5.6. Interorbital region and rostrum very broad, anterior slope of the braincase gentle, not abrupt.

In addition to the type, three specimens from Inca Mines, Peru, and five specimens from Juntas da Tamaná, Chocó district, Colombia, are referred to this species. The latter are skins without skulls, but agree with the type in all external features. The Inca Mines specimens agree in cranial characters as well as in size and coloration.

Myotis caucensis is much larger than any of the other *Myotis* species described in the present paper, except *M. ruber keaysi,* from which it differs too much in coloration, in the character of the pelage, and in the naked instead of hairy interfemoral membrane, to require further comparison. It agrees, however, with *M. r. keaysi* in the form of the skull, the rostrum being broad, and the braincase rising therefrom by a gentle slope instead of abruptly as in the other species of *Myotis* here described.

Nyctinomus æquatorialis sp. nov.

Type (and only specimen), No. 34383, Chone, Manavi, Ecuador, Feb. 2, 1913; Wm. B. Richardson.

Upperparts Prout's brown, basal half of hairs white; underparts similar but a little paler; ears, feet and membranes black. Ears very large, reaching far beyond the nose (length 24 mm. in dry skin). Tragus short and narrow, antitragus small.

Forearm, 58; third metacarpal, 63; third finger, 110; foot, 11. Skull, total length, 24; zygomatic breadth, 13; interorbital breadth, 4; breadth of braincase, 10; mastoid breadth, 12; lacrymal breadth, 6; upper toothrow (with canine), 6.2.

This species is nearly related to *Nyctinomus affinis* (Allen), from Santa Marta, Colombia, and *N. depressus* Ward, from Mexico, having practically the same external and cranial measurements. It is, however, paler, with thinner, less stiff and leathery ears, heavier dentition, narrower interorbital region, squarer braincase (more angular in front), and larger lacrymal processes. *N. depressus* differs from both *N. affinis* and *N. æquatorialis* in the shape of p^4. The ear of the latter is narrower and longer than in either *affinis* or *depressus*, and the thumb larger.

Mormopterus peruanus sp. nov.

Type, No. 16075, ♀ ad., Inca Mines (altitude 6000 feet), Peru (lat. 13° 30′ S., long. 70° W.), March 14, 1900; H. H. Keays.

Upperparts between Prout's brown and mummy brown, the hairs uniformly colored to the base; underparts buffy brown; ears and membranes black. Collector's measurements: Extent, 330; total length, 105; head and body, 60; tail, 45. Forearm (in skin), 43.5; third metacarpal, 43.5; third finger, 80; foot, 10. Skull, total length, 17; zygomatic breadth, 10; interorbital breadth, 4; lacrymal breadth, 6; breadth of braincase, 8.5; mastoid breadth, 9.3; upper toothrow (with canines), 6.2. A male topotype is exactly similar to the type in coloration and nearly of the same size, being only slightly larger in some measurements.

This species is allied to *Mormopterus kalinowskii* (Thomas),[1] but is larger (forearm 43.5, in *kalinowskii* 34.5) and much darker, and the wing membranes are *not* " edged posteriorly with white."

Premolars $\frac{2}{2}$ in both specimens; no lacrymal process,[2] the lacrymal border being merely thickened. Represented by two specimens, collected by H. H. Keays in 1900.

Thrinacodus apolinari sp. nov.

Plate XXVIII.

Type (and only specimen), No. 36245, ad. (♂?), Tomeque (altitude 6500 feet), Bogotá district, Colombia, March 7, 1914; collected and presented by Brother Apolinar Maria, for whom the species is named.

Pelage long and soft, longest hairs on the back about 30 mm. in length. Upperparts yellowish brown, lighter and more fulvous on the sides and strongly lined with black on the back, the hairs ashy gray for the basal half; nose and front of head grayish lined with black, passing gradually on the top of the head into the color of the back, with the black hair tips long and conspicuous; cheeks, inside of limbs and underparts yellowish white, separated from the upperparts by a pale yellowish lateral

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[1] Proc. Zool. Soc. London, 1893, p. 334, pl. xxix, fig. 10.

[2] *Cf.* Miller, Bull. Amer. Mus. Nat. Hist., 1899, pp. 173–176, fig. 1, *Mormopterus minutus* (Miller).

line; outer surface of limbs like the flanks, the toes grayish; soles naked, dark brown; ears pale brown, short, broad, and evenly rounded above, thinly haired on both surfaces; whiskers numerous, black, very long (the longest about 80 mm. in length) and conspicuous; tail long, pale brown above and on the sides, paler below but not sharply bicolor, hairy, the hairs not wholly concealing the annulations for the basal two-thirds but increasing in abundance apically, and ending in a thick pencil, the hairs pale brownish and lustrous.

Total length (approximate from dry skin), 340; head and body, 80; tail vertebræ, 260; hind foot, 40; ears from crown, 13; breadth of ears, 16. Skull, occipitonasal length, 57; zygomatic breadth, 26.8; interorbital breadth, 11.6; breadth of braincase, 20; mastoid breadth, 19; maxillary toothrow, 14; diastema, 11; palatal foramina, 1.8×3.

Thrinacodus apolinari closely resembles in pattern of coloration the colored figure of Günther's *Thrinacodus albicauda* (P. Z. S., 1879, pp. 144, 145, pl. X), the heretofore only known species of the genus, except that in *T. albicauda* the terminal half of the tail is white instead of concolor with the basal half, the upper parts are suffused with rufous instead of yellow, the underparts are white instead of yellowish white, and the animal is smaller, even allowing for its immaturity. Günther's specimen was from "the vicinity of Medellin," Colombia, and is apparently the only specimen of the genus heretofore recorded. It was a young animal with an imperfect skull, and only the front half with two molariform teeth (p^4 and m^1) is figured (see text-figure, *l. c.*, p. 145). The present specimen, from the eastern slope of the Eastern Andes, near Bogotá, is an adult (apparently male) with a perfect skull, and affords an opportunity to more fully illustrate the cranial characters of the genus (see Plate XXVIII).

Thrinacodus is intermediate in its structural relations between *Kannabateomys* and *Isothrix* on the one hand and *Dactylomys* on the other. It is similar in size and color pattern to *Kannabateomys* and *Isothrix*, but the feet are relatively much narrower than in *Isothrix* and the toes much slenderer. The form of the skull, as seen from above, is in general similar to that of *Isothrix*, both having the interorbital border straight and not convex outwardly as in *Dactylomys* and *Kannabateomys*; but in *Thrinacodus* the general form of the skull is narrower and more elongate anterior to the braincase, the rostrum being relatively narrower and more tapering and the interorbital region also much narrower. The zygomata, on the other hand, are very much broader and heavier in *Thrinacodus* than in *Isothrix*. The differences in the form of the skull, as seen from below, are equally marked through the very different form of the orbital fossæ, which are narrower and oval in front in *Thrinacodus* and wider and not narrowed anteriorly in *Isothrix*. In *Thrinacodus* the prepalatal foramina are very small and subcircular, in *Isothrix* much larger and twice as long as broad. But the radical difference is in the maxillary toothrows, which are twice sa

broad and converge anteriorly till they nearly meet, instead of diverging both anteriorly and posteriorly, with the point of least separation at the middle of the toothrows as in *Isothrix*. But the most important difference is in the structure of the teeth, which differ radically in enamel pattern, while the teeth themselves are low (brachyodont) and very broad in *Thrinacodus* and high (hypsodont) and narrow in *Isothrix*. Hence notwithstanding the external similarity and the superficial resemblances in the skulls of the two genera they have no very close genetic relationship.

On the other hand, while the external resemblances of *Thrinacodus* to *Dactylomys* are remote, and the general form of the skull in the two genera is quite different, the form and structure of the teeth are practically the same in both genera. In both the teeth are broad, heavy and brachyodont, with an exactly similar enamel pattern, and a similar convergence anteriorly of the maxillary toothrows. There are numerous minor cranial differences in the two genera, but these alone are hardly of sufficient importance to warrant the generic separation of the two groups. They are therefore genetically more closely related than is either to any other genus of the Octodontidæ, but their divergence in external characters (denoting very different habits), taken with the cranial differences, affords sufficient basis for the recognition of *Thrinacodus* as separable generically from *Dactylomys*. In *Dactylomys* digits 3 and 4 of the fore foot are of practically equal length and size, with digit 5 very short, and digit 2 about half the length of 3 and 4. In *Thrinacodus* digits 2, 3, and 4 are subequal in length and digit 5 is relatively longer than in *Dactylomys*. In the hind foot in *Dactylomys* digits 3 and 4 are longest and subequal, digit 2 is much shorter, digit 1 is greatly reduced, and digit 5 is a little shorter than digit 2. In *Thrinacodus* digits 2, 3, and 4 are longest and subequal, digit 5 is about one third shorter than digits 2–4, with digit 1 well developed.

In *Thrinacodus* the tail is heavily haired throughout its length, without extension of the body pelage on to the extreme base; in *Dactylomys* the tail is naked and heavily scaled throughout its length except at the extreme base, which for 45 mm. is covered with an extension of the body pelage, as in *Philander* and some other genera of the smaller opossums.

It remains to be noted that my *Dactylomys peruanus* is intermediate in many features between *D. dactylinus* and *Thrinacodus apolinari*. In coloration and size *T. apolinari* is very similar to *D. peruanus*, but the digital formula is different, and the tail in *D. peruanus* is heavily furred for the basal fourth, as in *D. dactylomys*, and well haired (not naked and heavily scaled as in *D. dactylomys*) for the rest of its length. While *D. peruanus* thus approaches *Thrinacodus* in external characters, it agrees wholly with *D. dactylomys* in cranial features, in foot structure and in furred tail-base.

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Article XXX.— A PRELIMINARY LIST OF THE COLEOPTERA OF THE WEST INDIES AS RECORDED TO JAN. 1, 1914.

By Charles W. Leng, B. S., Honorary Curator of Coleoptera, and Andrew J. Mutchler, Assistant.

PREFACE.

This list was commenced in the form of a card catalogue by the late Martin L. Linell, while employed in the National Museum. Following his death it was continued by E. A. Schwarz as rapidly as other duties permitted. The writer, in the identification of the coleoptera collected by the Museum expeditions in Florida, found a list of West Indian Coleoptera necessary for comparison and compiled such a list from the Catalogus Coleopterorum of Gemminger and Harold, Chevrolat's Coleoptera of Cuba, Fleutiaux's Coleoptera of Guadeloupe and other sources. Through the favor of Dr. Leland O. Howard, the cards prepared by Messrs. Linell and Schwarz were then loaned to us for comparison and the resulting corrected list, compiled from independent sources, may be regarded as substantially complete as far as the older records are concerned. In bringing the list up to recent date, a search of the Zoölogical Record and of the Biologia Centrali-Americana has been conducted by Andrew J. Mutchler, and all papers bearing upon West Indian species have been examined by the writer, as well as those taxonomic papers dealing in whole or in part with such species. Finally the list has been compared with the Junk catalogues, as far as issued, and with Genera Insectorum, and for the Cuban species, with the Coleopteros de Cuba of Dr. Juan Gundlach, a work that seems to be seldom quoted, though rich in information.

While the list is believed to be fairly complete as far as published records are concerned, it must be admitted that there are many more West Indian species than are here enumerated. This is indicated by the preponderance of records in certain obscure families that have been closely worked in Guadeloupe and Grenada, by which it would appear that the number of species there existing exceeded the number in the larger islands; and it became remarkably evident in the examination the writer was permitted to make, through the kindness of Dr. Carlos de la Torre, of the collection and manuscript note book of Dr. Gundlach, carefully preserved in Havana. Even in Cuba, where the records are comparatively copious, the unrecorded and undescribed species probably exceed in number those that are recorded.

The list is therefore preliminary in actual fact and the object in view in publishing it at this time is to stimulate research, to draw out from hidden sources the information needed to bring its successor nearer to completion, and to indicate to the possessors of such information what of it is new and therefore worthy of publication. This list in its specific names and authorities will also commemorate the early field work among others of Poey, Gundlach and Lanier in Cuba, of L'Herminier, Vitrac and Dufau in Guadeloupe, of Smith in Grenada, as well as the work of Duval, Chevrolat, Grouvelle, Fleutiaux, Arrow, Champion, and Gahan in studying their captures; and will we trust encourage local students to pursue their investigations.

In view of the paucity of West Indian records no comparative tables of distribution can profitably be prepared at present. In a general way it is evident that the relation of West Indian genera with those of the American continent is very intimate, that those of the more southerly islands are closely allied, as a whole, with those of South America, while those of Cuba show a much stronger mixture of North American forms. There is a striking development of certain genera, as Leucocera in Chrysomelidæ, and Exophthalmus in the Rhynchophora, by which the number of West Indian species in those genera far exceeds that of all other regions combined; and similar instances occur in other families. Instances of specific identity with American forms are not numerous and occur mainly as the result of commercial introduction. Among the water beetles of notoriously strong flight and seashore species there are further instances of such specific identity; and there are scattered cases throughout the list, the latter being possibly due in part to faulty identifications. There is apparently a tendency also for many species to be restricted to a single island, as certain genera are restricted or nearly so, to the islands in general. An isolated fact of interest is the apparently total absence of the Silphidæ, or Burying Beetles. A most interesting field of investigation is open to American Entomologists, and considering its geographical proximity, it is surprising that its working out has been so largely left to European authors, Casey and Schæffer being practically the only recent American authors cited.

No attempt has been made to include the unpublished records of West Indian species contained in the collections of this Museum, or of those in the collections of other Museums or private individuals. We hope to publish such additions later, after the material gathered by our expeditions has been identified; and we shall be thankful for any papers or manuscript notes bearing on the subject that readers may be able to send us.

Charles W. Leng.

Jan. 1, 1914.

Families.

Arranged according to the Leconte classification with such alterations as are generally adopted, for example the transfer of the Rhipidandri to Tenebrionidæ. The genera usually follow the order of the Junk "Catalogus Coleopterorum," as far as issued, or that of the latest published catalogue, as Van den Branden's in the Dytiscidæ, or in default of either, that of the "Catalogus Coleopterorum" of Gemminger & Harold. In the Carabidæ, the order has been reversed to bring the lowest genera first. Synonymy has been included only when necessary to connect the list with the Henshaw list of America north of Mexico and Chevrolat's partial list of Cuban beetles.

Family I. CARABIDÆ.

Subfamily Cicindelinæ.

Tetracha *Hope.*

carolina Linné (*occidentalis* Klug). Cuba.
acutipennis Dejean (*adonis* Laporte). Haiti, Cuba.
sobrina var. *infuscata* Mannerheim. St. Croix, St. Thomas, Porto Rico, Haiti, Cuba (?).

Cicindela *Linné.*

marginata Fabricius. Bahamas, Cuba.
boops Dejean. Haiti, Cuba.
viridicollis Dejean. Cuba.
olivacea Chaudoir. Cuba.
suturalis Fabricius (*hebraea* Kl.). Barbados, Guadeloupe.
rufiventris Dejean. Haiti.
trifasciata Fabricius (*tortuosa* Dejean). Guadeloupe, St. Thomas, Jamaica, Grand Cayman, Cuba.
argentata Fabricius. Guadeloupe.

Subfamily Carabinæ.

Bembidium *Latreille.*

chevrolati Gemminger & Harold (*apicale* Duval). Cuba.
fastidiosum Laferté. Cuba.
affine Say. Cuba.

Pericompsus *Leconi*

blandulus Schaum. Porto Rico, Cuba.

Tachys *Schaum.*

piceolus Laferté. Porto Rico.
putzeysi Fleutiaux. Guadeloupe.

Tachyta *Kirby.*

autumnalis Bates. Guadeloupe.

Lachnophorus *Dejean.*

leucopterus Chevrolat. Cuba.

Pogonus *Dejean.*

rutilus Chevrolat. Cuba.

Metallosomus *Motschulsky.*

cuprascens Motschulsky. Haiti.

Colpodes *MacLeay.*

dejeani Chaudoir. Guadeloupe.
jaegeri Dejean. Haiti.
lherminieri Chaudoir. Guadeloupe.
mannerheimi Chaudoir. Haiti.
elongatus Chaudoir. Guadeloupe.
alternans Chaudoir. Guadeloupe.
memnonius Dejean. Guadeloupe.
chalybeus Dejean. Guadeloupe.
ellipticus Chaudoir. Martinique.

Platynus *Bonelli.*

extensicolle Say. Cuba.

Loxandrus *Leconte.*

cubanus Tschitscherine. Cuba.

Stenolophus *Dejean.*

cruentatus Chevrolat. Cuba.

Harpalus *Latreille.*

integer Fabricius. Haiti.

Hypolithus *Dejean.*

iridescens Chaudoir. Guadeloupe.

Selenophorus *Dejean.*

æneocupreus Dejean. Jamaica.
alternans Dejean. Guadeloupe.
chalybeus Dejean. Haiti, Cuba.
cuprinus Dejean. Antilles, Cuba.
discopunctatus Dejean. Cuba.
flavilabris Dejean. Antilles.
parumpunctatus Dejean. Cuba.
propinquus Putzeys. Guadeloupe.
pyritosus Dejean. Cuba.
sinuatus Gyllenhal. Guadeloupe.
subaeneus Reiche. Guadeloupe.
striatopunctatus Putzeys. Antilles.

Gynandropus *Dejean.*

guadeloupensis Fleutiaux. Guadeloupe.

Amblygnathus *Dejean.*

vitraci Fleutiaux. Guadeloupe.

Stenocrepis *Chaudoir.*

sulcatus Chevrolat. Cuba.
insulanus Jacquelin Duval. Cuba.

Stenous *Chaudoir.*

tibialis Chevrolat. Cuba.
pallipes Reiche. Cuba.

Oodes *Bonelli.*

amaroides Dejean. Cuba.

Chlænius *Bonelli.*

gundlachi Chaudoir. Cuba.
perplexus Dejean (*circumcinctus* Say, *poeyi* Chev.). Cuba.
cubanus Chaudoir. Cuba.
niger Randall. Cuba.

Panagæus *Latreille.*

quadrisignatus Chevrolat. St. Thomas.

Aspidoglossa *Putzeys.*

comma Putzeys. Cuba.
semicrenata Chaudoir (*guadelupensis* Putzeys). Guadeloupe.
aerata Putzeys. Antilles.
vulnerata Putzeys (*bipustulata* Fab.?). Cuba.

Ardistomis *Putzeys.*

mannerheimi Putzeys. Porto Rico.
elongatula Putzeys. Cuba.
atripennis Putzeys. Guadeloupe.
cyaneolimbata Chevrolat (*gundlachi* Putzeys). Cuba.
laevistriata Fleutiaux. Guadeloupe.

Clivina *Latreille.*

simplex Chevrolat. Cuba.
limbipennis Jacquelin Duval. Cuba.
marginipennis Putzeys. Guadeloupe.
biguttata Putzeys. Cuba.
dentipes Dejean. Cuba.
bisignata Putzeys. Cuba.
insularis Jacquelin Duval. Cuba.

Oxydrepanus *Putzeys.*

rufus Putzeys. Cuba.

Stratiotes *Putzeys.*

iracundus Putzeys. Martinique.

Scarites *Fabricius.*

alternans Chaudoir. Cuba.
subterraneus Fabricius. Cuba.
sp.? Bahamas.

Morio *Latreille.*

monilicornis Latreille (*georgiæ* Beauv.). Cuba.

Pachyteles *Perty.*

gyllenhalli Dejean. Antilles, Cuba.

delauneyi Fleutiaux. Guadeloupe.

Coptodera *Dejean.*

festiva Dejean. Cuba.

unicolor Chaudoir. Cuba.

Rhombodera *Reiche.*

picea Chaudoir. Guadeloupe.

flavipes Leconte. Cuba.

bicolor Leconte. Cuba.

Perigona *Castelnau.*

nigriceps Dejean. Guadeloupe.

guadeloupensis Fleutiaux. Guadeloupe.

Plochionus *Dejean.*

pallens Fabricius. Bahamas, Cuba.

Masoreus *Dejean.*

brevicollis Chevrolat. Cuba.

Gallerucidia *Chaudoir.*

dimidiata Chevrolat. Cuba.

Lebia *Latreille.*

viridis Say. Cuba.

cyanea Dejean. Cuba.

bitaeniata Chevrolat. Cuba.

abdominalis Chaudoir. Cuba.

?pleurodera Chaudoir. Cuba.

Aphelogenia *Chaudoir.*

frenata Chaudoir var. *apicalis.* Guadeloupe.

Blechrus *Motschulsky.*

poeyi Jacquelin Duval. Cuba.

Apenes *Leconte.*

purpuratus Fleutiaux. Guadeloupe.

parallela Dejean. Cuba.

Cymindis *Latreille.*

sulcicollis Jacquelin Duval. Cuba.

marginalis Dejean. Guadeloupe.

pallipes Fabricius. Guadeloupe.

coriacea Chevrolat. Cuba.

Callida *Dejean.*

elegans Chaudoir. Cuba.

pretiosa Chaudoir. Haiti.

decolor Chaudoir. Martinique.

rubricollis Dejean. Cuba.

Brachinus *Weber.*

gilvipes Mannerheim. St. Thomas, Cuba.

lateralis Dejean. Cuba.

Galerita *Fabricius.*

vetula Chevrolat. Cuba.

americana Linné. Guadeloupe.

beauvoisi Chaudoir. Antilles.

erythrodera Brullé. Cuba.

tenebricosa Klug. Haiti.

striata Klug. Haiti.

unicolor Dejean. Guadeloupe, Haiti.

Leptotrachelus *Latreille.*

dorsalis Fabricius. Cuba.

Casnonia *Latreille.*

limbata Waterhouse. Jamaica.

picta Chaudoir. Cuba.

Calosoma *Weber.*

splendidum Dejean. Haiti, Cuba.

imbricatum Klug. Antilles.

alternans Fabricius (?*armatus* Cast.) Jamaica, Porto Rico, Cuba.

Carabus *Linné.*

basilicus Chevrolat. Antilles.

Omophron *Latreille.*

dominicensis Chaudoir. Haiti.

Family II. HALIPLIDÆ.

Haliplus *Latreille.*

robustus Sharp. Antigua, Guadeloupe.

havaniensis Wehncke. Cuba.

brandeni Wehncke. Haiti.

Family III. DYTISCIDÆ.

Megadytes *Sharp.*

fraternus Sharp. Antigua, Guadeloupe, Haiti, Cuba?

giganteus Castelnau. Antigua, Guadeloupe, Cuba.

Cybister *Curtis.*

occidentalis Aubé. Cuba.

Eunectes *Erichson.*

occidentalis White. St. Bartholomew.

Eretes *Castelnau.*

sticticus Linné. Guadeloupe.

Acilius *Leach.*

semisulcatus Aubé. Haiti.

Thermonectes *Eschscholtz.*

basilaris Harris. Gaudeloupe, Cuba.
margineguttatus Aubé. Antigua, Guadeloupe, Cuba.
circumscriptus Latreille. Antigua, Guadeloupe, Cuba.

Hydaticus *Leach.*

cinctipennis Aubé. Guadeloupe.
rimosus Aubé. Guadeloupe, Cuba.

Rhantus *Lacordaire.*

riehli Wehncke. Cuba.
calidus Fabricius. Guadeloupe, Cuba.
binotatus Harris. Haiti.

Copelatus *Erichson.*

posticatus Fabricius. Guadeloupe, Cuba.
glyphicus Say. Guadeloupe, Cuba.
insolitus Chevrolat. Jamaica, Haiti, Cuba.
angustatus Chevrolat. Cuba.
cœlatipennis Aubé. Antilles.
cubænsis Schaeffer. Cuba.

Bidessus *Sharp.*

apicatus Clark. Haiti.
caraibus Chevrolat. Cuba.

Hydrovatus *Motschulsky.*

caraibus Sharp. Guadeloupe.

Laccophilus *Leach.*

quadrivittatus Aubé. Antilles.
venustus Chevrolat. Cuba?
bifasciatus Chevrolat. Haiti, Cuba.
subsignatus Sharp. Guadeloupe.
americanus Aubé. Antigua, Guadeloupe. Cuba.

Derovatellus *Sharp.*

lentus Wehncke. Antilles.

Canthydrus *Sharp.*

tenuicornis Chevrolat. Cuba.
rufipes Sharp. Cuba.
binotatus Fleutiaux. Guadeloupe.
subsignatus Sharp. Guadeloupe.
insularis Sharp. Haiti.
nigrinus Aubé. Guadeloupe.

Hydrocanthus *Say.*

iricolor Say. Guadeloupe.

Suphis *Aubé.*

cimicoides Aubé. Antigua, Guadeloupe.

Pachydrus *Sharp.*

brevis Sharp. Antilles.
cribratus Sharp. Guadeloupe.
obniger Chevrolat. Cuba.
globosus Aubé. Guadeloupe, Porto Rico.
?n. sp. Sharp. Antigua.

Pronoterus *Sharp.*

obscuripennis Fleutiaux. Guadeloupe.

Family IV. GYRINIDÆ.

Dineutes *MacLeay.*

longimanus Olivier. Antilles, Cuba.
metallicus Aubé. Antigua, Cuba.

Gyrinus *Geoffroy.*

cubensis Regimbart. Cuba.
rugifer Regimbart. Guadeloupe.

Gyretes *Brullé.*

cubensis Regimbart. Cuba.
distinguendus Regimbart. Grenada.
morio Aubé. Guadeloupe, Antigua.
vulneratus Aubé. Haiti, Cuba.

Family V. HYDROPHILIDÆ.

Hydrochus *Leach.*

pallipes Chevrolat. Cuba.
tarsalis Chevrolat. Cuba.

Berosus *Leach.*

chevrolati Zaitzev (*aculeatus* || Chev.) Cuba.
guadelupensis Fleutiaux. Guadeloupe.
quadridens Chevrolat. Cuba.
tesselatus Fleutiaux. Guadeloupe.
trilobus Chevrolat. Cuba.

Derallus *Sharp.*

rudis Sharp. Guadeloupe.

Stethoxus *Solier.*

ater Olivier (*intermedius* Duv.) St. Lucia, St. Thomas, Haiti, Porto Rico, Cuba.
insularis Castelnau. Trinidad, Barbados, Martinique, Antigua, Guadeloupe, Haiti, Cuba.

Dibolocelus *Bedel.*

smaragdinus Brulle (*violaceonitens* Duv.) Cuba.

Hydrophilus *DeGeer.*

tenebrioides Jacquelin Duval. Guadeloupe, Cuba.

Tropisternus *Solier.*

agilis Castelnau. Barbados, St. Vincent.
blandus Chevrolat. Cuba.
chalybeus Castelnau (*nitidus* Cast.) Guadeloupe.
glaber Herbst. Haiti.
lateralis Fabricius. Barbados, Antigua, Guadeloupe, Cuba.
proximus Sharp. Cuba.
?collaris Fabricius. Cuba.
?corvinus Chevrolat. Antigua.

Paracymus *Thomson.*

armatus Sharp. Guadeloupe.

Philhydrus *Solier.*

æqualis Sharp. Guadeloupe.
coriaceus Chevrolat. Cuba.
pallidus Castelnau. Guadeloupe.
?melanocephalus Olivier. Cuba.

Helopeltis *Horn.*

larvalis Horn. Cuba.

Dactylosternum *Wollaston.*

abdominale Fabricius. Guadeloupe.
flavicorne Mulsant. Jamaica, Cuba.
picicorne Mulsant. Jamaica, Cuba.
subdepressum Castilnau. Cuba.

Phaenonotum *Sharp.*

estriatum Say. Guadeloupe.

Cercyon *Leach.*

cribratus Castelnau. Guadeloupe.
insularis Chevrolat. Cuba.
nigriceps Marsham (*centrimaculatum* Sturm). Guadeloupe.

Pelosoma *Mulsant.*

rufipes Fleutiaux. Guadeloupe.

Family VI. SCYDMÆNIDÆ.

Eumicrus *Castelnau.*

pubescens Schaufuss. Cuba.
brevicornis Schaufuss. Cuba.

Euconnus *Thomson.*

felinus Reitter. St. Thomas.
coralinus Reitter. St. Thomas, Water Id., Porto Rico.
dominus Reitter. St. Thomas.
testaceus Schaum. St. Thomas, Porto Rico.
atomus Reitter. St. Thomas.

Napochus *Thomson.*

tantillus Reitter. St. Thomas, Porto Rico.
amœnus Reitter. St. Thomas, Porto Rico.

Scydmænus *Latreille.*

gundlachi Schaufuss. Cuba.
patens Schaufuss. Cuba.
globulicollis Schaufuss. Cuba.
breviceps Schaufuss. Cuba.

Homoconnus *Sharp.*

dentipes Schaufuss. Cuba.

Family VII. PSELAPHIDÆ.

Bythinoplectus *Reitter.*

acutangulus Raffray. Grenada.
foveatus Reitter. St. Thomas.

Jubus *Schaufuss.*

insularis Raffray. Guadeloupe.
clavatus Raffray. Grenada.

Balega *Reitter.*

elegans Reitter. St. Thomas.

Trimiosella *Raffray.*

anguina Reitter. St. Thomas.

Melba *Casey.*

specularis Reitter. St. Thomas, Water Id., Dominica.
gibbula Reitter. St. Thomas.
grenadensis Raffray. Grenada.
crassipes Raffray. Guadeloupe.
inconspicua Reitter. St. Thomas.
eggersi Reitter. St. Thomas, Porto Rico.
quadrifoveata Raffray. St. Thomas.
temporalis Raffray. Martinique.
frontalis Raffray. Guadeloupe.
clypeata Reitter. St. Thomas.
fleutiauxi Raffray. Guadeloupe.
ventricosa Reitter. St. Thomas, Porto Rico.
parmata Reitter. St. Thomas, Porto Rico.

Euplectus *Leach.*

exiguus Raffray. St. Vincent.
insularis Raffray. Guadeloupe.
illepidus Raffray. Grenada.

Thesiastes *Casey.*

liliputanus Raffray. Grenada.
argus Reitter. St. Thomas ?

Ramecia *Casey.*

impressa Raffray. Guadeloupe.
minuta Raffray. St. Vincent, Grenada.

Rhexinia *Raffray.*

versicolor Raffray. Guadeloupe.

Bythinogaster *Schaufuss.*

simplex Schaufuss. Haiti.
?bisphaeroides Schaufuss. Cuba.

Berdura *Reitter.*

excisula Reitter. St. Thomas.

Scalenarthrus *Leconte.*

clavatus Raffray. Grenada.
guadelupensis Raffray. Guadeloupe.
pectinicornis Raffray. Grenada, St. Vincent, Guadeloupe.

Pselaptus *Leconte.*

sternalis Raffray. Grenada.
longiclava Schaufuss. Cuba.

Achillia *Reitter.*

excisa Schaufuss. Cuba.

Reichenbachia *Leach.*

grenadensis Raffray. Grenada.
vincentania Raffray. St. Vincent.
guadelupensis Raffray. Guadeloupe.
eucera Aubé. Porto Rico.
?bisinuata Schaufuss. Cuba.
?truncata Schaufuss. Cuba.

Decarthron *Brendel.*

insulare Raffray. Grenada.
spinosum Raffray. Grenada.
unifoveolatum Schaufuss. Cuba.

Eupsenius *Leconte.*

gracilis Raffray. Grenada.
dominicanus Schaufuss. Haiti.
politus Reitter. St. Thomas, Guadeloupe.

Dalmodes *Reitter.*

humilis Raffray. Guadeloupe.
ensipes Raffray. Venezuela, Guadeloupe?

Ephimia *Reitter*

simoni Reitter. St. Thomas.
subnitida Raffray. Grenada.

Hamatoides *Schaufuss.*

hirtus Raffray. Grenada, St. Vincent, Guadeloupe.

Fustiger *Brendel.*

smithi Raffray. St. Vincent.

Pseudofustiger *Reitter.*

stricticornis Reitter. St. Thomas.

Family VIII. STAPHYLINIDÆ.

Piestus *Gravenhorst.*

capricornis Castelnau. Guadeloupe.
erythropus Erichson. Cuba.
fulvipes Erichson. Guadeloupe, Haiti.
mexicanus Castelnau. Haiti.
pygmæus Castelnau. Haiti, Guadeloupe.

Leptochirus *Germar.*

maxillosus Fabricius. Antilles.

Ancæus *Fauvel.*

exiguus Erichson. Guadeloupe, Porto Rico.

Lispinus *Erichson.*

anguinus Fauvel. Haiti, Antilles.
attenuatus Erichson. Porto Rico.
fauveli Sharp (*tenellus* Chev. & Fauv. not Er.). Guadeloupe, Cuba.
granadensis Fauvel. Haiti, Cuba.
insularis Fauvel. Haiti, Cuba.
var: *piceus* Chevrolat. Cuba.
laticollis Erichson. Porto Rico, Cuba.
nigrifrons Fauvel. Cuba.
striola Erichson. Cuba.

Espeson *Schaufuss.*

crassulus Fauvel. St. Vincent, Guadeloupe.
crenicollis Fauvel. Key Island.
euplectoides Fauvel. Guadeloupe.
moratus Schaufuss. St. Thomas.
nitens Fauvel. Guadeloupe.

Thoracophorus *Motschulsky.*

brevicristatus Horn. St. Thomas, Guadeloupe.
denticollis Erichson. Porto Rico.
ruficollis Fauvel. Guadeloupe.

Omalium *Gravenhorst.*

lachrymale Fleutiaux. Guadeloupe.
pedicularium Erichson. Porto Rico.

Trogophlœus *Mannerheim.*

arcuatus Stephens. Cuba?
croceipes Fauvel (*arcuatus* Fauv.) Guadeloupe, Cuba.
æqualis Jacquelin Duval. Cuba.
aridus Jacquelin Duval (*rubripennis* Fauv.) Cuba.
corticinus Gravenhorst. Guadeloupe.
var: *fulvipennis* Fauvel. Cuba.
flavipes Erichson. St. Thomas, St. John, Cuba.
fulvipes Erichson. Porto Rico, Cuba.
smithi Bernhauer. Grenada.
varicornis Bernhauer. Grenada.

Parosus *Sharp.*

skalitskyi Bernhauer. Grenada, St. Vincent.

Apocellus *Erichson.*

ustulatus Erichson. Antilles.

Oxytelus *Gravenhorst.*

dentifrons Fauvel. Antilles.
ferrugineus Kraatz. Antilles.
glarcesus Wollaston. Antilles.
insignitus Gravenhorst. Guadeloupe, St. Thomas, Cuba.
scorpio Fauvel. Haiti.

Platystethus *Mannerheim.*

exiguus Jacquelin Duval. Cuba.

Thinobius *Kiesenwetter.*

nitidulus Bernhauer. Grenada.

Holotrochus *Erichson.*

cylindrus Erichson. Porto Rico.
minor Fauvel. Cuba.
volvulus Erichson. Porto Rico.

Osorius *Latreille.*

eggersi Bernhauer. St. Thomas.

Hypostenus *Rey.*

bakeri Bernhauer. Cuba.
cubensis Bernhauer. Cuba.

Tamotus *Schaufuss.*

femoratus Schaufuss. Cuba.

Pinophilus *Gravenhorst.*

flavipes Erichson. Porto Rico.

Palaminus *Erichson.*

variabilis Erichson. Guadeloupe.

Pæderus *Fabricius.*

morio Mannerheim. Haiti.
tricolor Erichson. Antilles.

Stilicopsis *Sachse.*

exigua Erichson. Porto Rico.

Stamnoderus *Sharp.*

delauneyi Fleutiaux. Guadeloupe.
labeo Erichson. Antilles.

Thinocharis *Kraatz.*

bakeri Casey. Cuba.
pertenuis Casey. Cuba.

Stilomedon *Sharp.*

connexus Sharp. Guadeloupe, Cuba.

Sciocharis *Arrib.*

bakeri Casey. Cuba.

Sciocharella *Casey.*

pertenuis Casey. Cuba.

Hypomedon *Casey.*

debilicornis Wollaston. Guadeloupe.

Lithocharis *Lacordaire.*

curtulus Erichson. Trinidad.
dorsalis Erichson. Guadeloupe, Porto Rico.
infuscata Erichson. Guadeloupe.
hilaris Sharp. Grenada.
limbatus Erichson. Antilles.
ochracea Gravenhorst. Antilles, Cuba.
posticata Erichson. Porto Rico.
vilis Kraatz. Guadeloupe.

Scopæus *Erichson.*

fasciatellus Erichson. Porto Rico.
pygmæus Erichson. Porto Rico.
illustris Fauvel. Cuba.

Lathrobium *Gravenhorst.*

margipallens Jacquelin Duval. Cuba.
pectorale Erichson. St. Thomas.
?rubida Fauvel. Cuba.

Cryptobium *Mannerheim.*

albipes Erichson. Porto Rico.
centrale Sharp. Guadeloupe.
marginellum Bernhauer. St. Vincent.
fulvipes Erichson. Grenada, Guadeloupe, Porto Rico.

Tanygnathus *Erichson.*

laticollis Erichson. Antilles.

Creophilus *Mannerheim.*

villosus Gravenhorst. Cuba.

Lampropygus *Sharp.*

pexus Motschulsky. Antilles.

Pæderomimus *Sharp.*

insularis Bernhauer. St. Thomas.
interjectus Bernhauer. St. Vincent.
lustralis Erichson. Porto Rico.

Ocypus *Stephens.*

cubæ Jacquelin Duval (*Staphylinus teste* Bernh). Cuba.

Philonthus *Curtis.*

alumnus Erichson. Porto Rico.
bilineatus Erichson. Lesser Antilles.
discoideus Gravenhorst (cosmopolitan). Cuba.
amazonicus Sharp (*figulus* Erichson?). Cuba.
flavolimbatus Erichson. Martinique.
havaniensis Castelnau (*obscurus* Fauv.). Porto Rico, St. John, Cuba.
humilis Erichson (*Neobisnius* Ganglb). St. Cruz, Porto Rico, Cuba.
varians Erichson. St. Vincent, St. John, Cuba.
ventralis Gravenhorst (cosmopolitan). St. Vincent, Guadeloupe.
vilis Erichson. St. Thomas, Guadeloupe, Haiti, Cuba.

Belonuchus *Nordmann.*

agilis Erichson (*chevrolati* Fauvel). Jamaica, Cuba.
bugnioni Fauvel. Martinique.
coelestinus Bernhauer. St. Vincent.
gagates Erichson. Porto Rico, Haiti, Cuba.
minax Erichson. St. Thomas, St. John, Antilles.

Xantholinus *Serville.*

attenuatus Erichson. St. Vincent, St. Thomas, Porto Rico, Cuba.
punctiger Gemminger & Harold. Cuba.
pusillus Sachse. Antilles.
rufescens Erichson. St. Thomas.
humeralis Erichson. Antilles.
hydrocephalus Fauvel. Trinidad.

Holisus *Erichson* (**Hyptioma** *Casey*).

cubensis Casey. Cuba.

Leptacinus *Erichson.*

eggersi Bernhauer. (*apicipennis*) Bernhauer. St. Thomas.
parumpunctatus Gyllenhal. (cosmopolitan). Cuba.
testaceipennis Fauvel (*Oligolinus* Csy). Haiti, Cuba.

Eulissus *Mannerheim.*

illucens Erichson. Antilles.

Diochus *Erichson.*

nanus Erichson. Cuba.

Cilea *Jacquelin Duval.*

hepatica Erichson. Porto Rico, Cuba.
rutilus Erichson. St. Thomas, Porto Rico, Cuba.
pulchellus Erichson. Guadeloupe, Haiti, Porto Rico, Cuba.

Erchomus *Motschulsky.*

piceus Erichson. Porto Rico.
apicalis Erichson. Porto Rico.
infimus Jacquelin Duval. Cuba.
nitidulus Erichson. Porto Rico.

Coproporus *Kraatz.*

terminalis Erichson. Porto Rico, Cuba.
convexus Erichson. Cuba.

Bolitobius *Stephens.*

obscurus Erichson. Porto Rico.

Hoplandria *Kraatz.*

terminata Erichson. Porto Rico.

Aleochara *Gravenhorst.*

bimaculata Gravenhorst. Haiti.
dubia Fauvel. Cuba.
lateralis Erichson. Cuba.
tæniata Erichson. Guadeloupe.
notula Erichson. St. Thomas, Guadeloupe, Cuba.
verberans Erichson (? *lateralis* Fauvel). Cuba.

Myrmedonia *Erichson.*

munda Erichson. St. Thomas.

Neolara *Casey.*

cubana Casey. Cuba.

Homalota *Mannerheim.*

alternata Erichson. St. Thomas.
flavipennis Erichson. Antilles.
melanura Erichson. Antilles.
nigripennis Erichson. Antilles.
propinqua Erichson. Antilles.

Diestota *Sharp.*

sperata Sharp. Guadeloupe, Haiti, Jamaica, Cuba.

Phlœopora *Erichson.*

subtusa Erichson. Antilles.

Eumicrota *Casey.*

cornuta Casey. Cuba.

Phanerota *Casey.*

cubensis Casey. Cuba.

Meronera *Sharp.*

albocincta Erichson. Cuba.

Falagria *Mannerheim.*

infima Sharp. St. Thomas.

Family IX. PTILIIDÆ.

(formerly TRICHOPTERYGIDÆ).

Ptenidium *Erichson.*

concinnum Matthews. Grenada, St. Vincent.

Ptilium *Erichson.*

impressum Matthews. St. Vincent.
smithsi Matthews. Grenada, St. Vincent.
rufotestaceum Matthews. Grenada.
tropicum Matthews. Grenada.

Throscidium *Matthews.*

invisible Nistner. Antilles.

Pteryx *Matthews.*

brunnea Leconte. Grenada.

Smicrus *Matthews.*

filicornis Fairmaire. Grenada.

Nephanes *C. G. Thomson.*

meridionalis Matthews. Grenada, Gaudeloupe.

Acrotrichis *Motschulsky.*

atomaria DeGeer. Porto Rico.
crotchi Matthews. Grenada, St. Vincent.
dubitata Matthews. St. Vincent.
laevicollis Matthews. Grenada, St. Vincent.
grenadensis Matthews. Grenada.
matthewsiana Csiki (*depressa* Matth.). Grenada, St. Vincent.
occidentalis Matthews. Antilles.
rufescens Matthews. Guadeloupe.

Actinopteryx *Matthews.*

fucicola Allibert. Grenada.

Family X. SCAPHIDIIDÆ.

Scaphosoma *Leach.*

cubense Reitter. Cuba.

Family XI. PHALACRIDÆ.

Heterolitus *Grouvelle.*

strigellus Guillebeau. Cuba.

Caelocœlius *Guillebeau.*

latisternus Guillebeau. Haiti.
insularis Guillebeau. Martinique.

Xanthocomus *Guillebeau.*

floralis Guillebeau. Cuba.
grouvellei Guillebeau. Haiti.

Stilboides *Guillebeau.*

sublineatus Guillebeau. Haiti.
grouvellei Guillebeau. Cuba.

Eustilbus *Sharp.*

univestis Guillebeau. Cuba.

Liostilbus *Guillebeau.*

testaceus Fabricius. St. Thomas.

Phalacrus *Paykull.*

flavangulus Chevrolat. Cuba.

Family XII. CORYLOPHIDÆ.

Sacium *Leconte.*

instabile Matthews. Grenada.

Arthrolips *Erichson.*

innotabilis Matthews. Grenada.
nitidus Matthews. Grenada.

Sericoderus *Stephens.*

minutus Matthews. Antilles.

Corylophodes *Matthews.*

pusillus Matthews. Grenada, St. Vincent.

Rypobius *Leconte.*

dissimilis Matthews. Grenada, St. Vincent.

Orthoperus *Stephens.*

perpusillus Matthews. Grenada, St. Vincent.
bahamicus Casey. Bahamas.

Family XIII. COCCINELLIDÆ.

Megilla *Mulsant.*

maculata DeGeer. St. Vincent.
innotata Mulsant. Porto Rico.
cubensis Casey. Cuba.

Hippodamia *Mulsant.*

tredecimpunctata Linné. Antilles.

Halyzia *Mulsant.*

quindecimpunctata Olivier. Haiti.
nigrovittata Crotch. Jamaica.

Psyllobora *Mulsant.*

punctella Mulsant. Trinidad, St. Vincent, Grenada.
nana Mulsant. Jamaica, Cuba.
lineola Fabricius. Martinique, Guadeloupe.

Cleis *Mulsant.*

humilis Mulsant. Trinidad, St. Vincent.

Procula *Mulsant.*

douei Mulsant. Jamaica.

Neda *Mulsant.*

antillensis Crotch. Trinidad.
ferruginea Olivier. Haiti, Porto Rico.

Cycloneda *Crotch.*

delauneyi Fleutiaux. Grenada, Guadeloupe.
sanguinea Linné. Grenada, Grenadines, St. Vincent, Guadeloupe, Jamaica, Haiti, Porto Rico, Cuba, Bahamas.
sallæi Mulsant. Antilles.
limbiter Casey. Bahamas.

Chilocorus *Leach.*

platycephalus Mulsant. Cuba.
cacti Linné. Antilles.

Scymnillus *Horn.*

lateralis Casey. Bahamas.
eleutheræ Casey. Bahamas.

Curinus *Mulsant.*

peleus Mulsant. Cuba.

Cladis *Mulsant.*

nitidula Fabricius. Martinique, Guadeloupe, Cuba.

Exochomus *Redtenbacher.*

uva Mulsant. Antilles.
cubensis Dimmock. Cuba.

Bura *Mulsant.*

cuprea Mulsant. Haiti.

Thallassa *Mulsant.*

flaviceps Mulsant (*prasina* Muls). Cuba.
pentaspilota Chevrolat. Cuba.

Brachyacantha *Chevrolat.*

bistripustulata Fabricius. Jamaica.

Hyperaspis *Redtenbacher.*

connectens Schönherr. St. Eustatius, St. Bartholomew, Jamaica, Porto Rico.
luteola Mulsant. Haiti.
apicalis Weise. Porto Rico.
festiva Mulsant. Grenada.
cincticollis Mulsant. Grenada.

Scymnus *Kugelann.*

floralis Fabricius. Porto Rico.
roseicollis Mulsant. Grenada, Grenadines, St. Vincent, Porto Rico, Guadeloupe, Cuba.
thoracicus Fabricius. Grenada, Grenadines, St. Vincent.
phloeus Mulsant. Porto Rico.
ochroderus Mulsant. Grenada, Grenadines, St. Vincent, St. Bartholomew, Guadeloupe, Porto Rico, Cuba.
loewii Mulsant. Porto Rico.
grenadensis Gorham. Grenada.

Azya *Mulsant.*

ardosiaca Mulsant. Guadeloupe.

Botynella *Weise.*

quinquepunctata Weise. Cuba.
quadripunctata Weise. Cuba.

Pentilia *Mulsant.*

egena Mulsant. Guadeloupe.

Cryptognatha *Mulsant.*

melanura Gorham. Grenada.

Epilachna *Chevrolat.*

patricia Mulsant. St. Croix.
borealis Fabricius. Cuba.

Cryptolæmus *Mulsant.*

montrouzii Mulsant (introduced). Porto Rico.

Family XIV. ENDOMYCHIDÆ.

Anidrytus *Gerstæcker.*

sp. ♀ Gorham. Grenada.

Rhymbus *Gerstæcker.*

globosus Gorham. Grenada.
unicolor Gorham. St. Vincent.

Dialexia *Gorham.*

punctipennis Gorham. Grenada.

Family XV. EROTYLIDÆ.

Ægithus *Fabricius.*

clavicornis Linné. Grenada.

Brachysphænus *Lacordaire.*

marginatus Olivier. Guadeloupe.

Ischyrus *Lacordaire.*

flavitarsis Lacordaire. Cuba.
fulvitarsis Lacordaire. Haiti.
graphicus Lacordaire. St. Vincent.
modestus Olivier. Haiti.
tripunctatus Crotch. Haiti.

Oocyanus *Hope.*

brunnipes Kuhnt. Cuba.
violaceus Sturm. Cuba.
tarsalis Lacordaire (*tarsatus* Lac.). Haiti, Cuba.

Tritoma *Fabricius.*

sellata Kuhnt. Cuba?

Diplocœlus *Guérin.*

costulatus Chevrolat. Cuba.
similis Grouvelle. Grenada.

(Note. Cryptophilus will be found in Cryptophagidæ).

Family XVI. COLYDIIDÆ.

Euxestus *Wollaston.*

erithacus Chevrolat. Guadeloupe, Haiti, Porto Rico, Cuba.
piciceps Gorham. Grenada.

Cerylon *Latreille.*

exaratum Chevrolat. Grenada, St. Vincent, Guadeloupe, Porto Rico, Cuba.
amaroides Chevrolat. Grenada, Cuba.

Metacerylon *Grouvelle.*

dufaui Grouvelle. Guadeloupe.

Discoloma *Erichson.*

circulare Chevrolat. Cuba.
erichsoni Reitter (*parmula* Chev.). Cuba.

Philothermus *Aubé.*

puberulus Schwarz. Grenada, St. Vincent, Guadeloupe.
guadelupensis Grouvelle. Guadeloupe.

Penthelispa *Pascoe* (**Pycnomerus** *Er.*).

longior Grouvelle. Guadeloupe.
exarata Chevrolat. Guadeloupe.
infima Grouvelle. Martinique.
armata Erichson. Cuba.
æqueicolle Reitter. Guadeloupe, Porto Rico.
sp. ? Champion. St. Vincent.

Bothrideres *Erichson.*

dufaui Grouvelle. Guadeloupe.
planus Chevrolat. Guadeloupe, Cuba.
dentatus Chevrolat. St. Vincent, Cuba.

Taphrideres *Sharp.*

chevrolati Grouvelle. Guadeloupe, Martinique.

Nematidium *Erichson.*

costipenne Jacquelin Duval. Grenada, Cuba.
? filiforme Leconte. Grenada.

Botrodus *Casey.*

dufaui Grouvelle. Guadeloupe.

Eulachus *Erichson.*

semifuliginosus Chevrolat. Porto Rico, Cuba.
quinquecarinatus Chevrolat. Cuba.
costatus Erichson. Antilles.

Colydium *Fabricius.*

brevicorne Reitter. Antilles.

Colydodes *Motschulsky.*

bostrychoides Grouvelle. Guadeloupe.

Aulonium *Erichson.*

bidentatum Fabricius. Porto Rico, Cuba.

Neotrichus *Sharp.*

tuberculata Chevrolat. Porto Rico, Cuba.
guadalupensis Grouvelle. Guadeloupe.
insularis Grouvelle. Grenada, St. Vincent.

Lemnis *Pascoe.*

denticulatus Grouvelle. Grenada, St. Vincent.
lherminieri Grouvelle. Guadeloupe.

Phlœonemus *Erichson.*

haroldi Reitter. Cuba.

Lasconotus *Erichson.*

atomus Grouvelle. Guadeloupe.

Synchita *Hellwig.*

laticollis Leconte. Grenada, St. Vincent, Guadeloupe.

granulata Say. Guadeloupe.

rugulosa Guérin. Cuba?

Sosylus *Erichson.*

castaneus Pascoe. Guadeloupe.

Ocholissa *Pascoe.*

læta Pascoe. Guadeloupe.

Ditoma *Herbst.*

trifasciata Moritz. Porto Rico.

quadricollis Horn. St. Vincent, Guadeloupe.

undata Guérin. Cuba.

longior Grouvelle. Guadeloupe.

exarata Pascoe. Haiti.

Microsicus *Sharp.*

minimus Grouvelle. Grenada, Guadeloupe.

Catolæmus *Sharp.*

exilis Grouvelle. Grenada, St. Vincent.

multimaculatus Grouvelle. Guadeloupe.

Lapethus *Casey.*

discretus Casey. Guadeloupe.

Lytopeplus *Sharp.*

insularis Grouvelle. St. Vincent.

Lithophrus *Sharp.*

succineus Pascoe. Haiti.

Cautomus *Sharp.*

infimus Grouvelle. Guadeloupe.

Stylulus *Schaufuss.*

nasutus Schaufuss. St. Thomas.

Cryptozoon *Schaufuss.*

civile Schaufuss. Porto Rico.

nitidicolle Schaufuss. Porto Rico.

Tyrtæus *Champion.*

rufus Champion. Cuba.

Ithris *Pascoe.*

perplexa Grouvelle. Guadeloupe.

Family XVII. MONŒDIDÆ. (ADIMERIDÆ).

Monœdus *Leconte* (**Adimerus** *Sharp*).

obscurus Grouvelle. Guadeloupe.
zonatus Grouvelle. Guadeloupe.
horni Grouvelle. Guadeloupe.
lecontei Fleutiaux. Guadeloupe.

Family XVIII. RHYSODIDÆ.

Clinidium *Kirby*.

guildingi Kirby. St. Vincent, Guadeloupe, Cuba.
humeridens Chevrolat. Cuba.
curvicosta Chevrolat. Cuba.

Family XIX. CUCUJIDÆ.

Passandra *Dalman*.

fasciata Gray. Cuba.

Scalidia *Erichson*.

linearis Leconte. Cuba.

Hemipeplus *Latreille*.

insularis Grouvelle. Haiti.
gundlachi Grouvelle. Cuba.

Inopeplus *Smith*.

præusta Chevrolat. St. Vincent, Guadeloupe.
insularis Grouvelle. Grenada, St. Vincent.

Platamus *Erichson*.

dufaui Grouvelle. Guadeloupe.

Telephanus *Erichson*.

parvulus Grouvelle. Guadeloupe.
terminatus Grouvelle. St. Vincent.
guadalupensis Grouvelle. Guadeloupe.
pallidulus Chevrolat. Guadeloupe, Porto Rico, Cuba.
paradoxus Reitter. Grenada.
apicalis Grouvelle. Cuba.
? elongatus Grouvelle. Grenada, St. Vincent.

Læmophlœus *Castelnau*.

pallentipennis Grouvelle. Grenada, St. Vincent, Guadeloupe.
pusillus Schönherr. Grenada, St. Vincent, Guadeloupe, Cuba.
gundlachi Grouvelle. ?
smithi Grouvelle. Grenada.
caseyi Grouvelle. Grenada.
castanipennis Grouvelle. Grenada.
nitens Leconte. Grenada.
commixtus Grouvelle. Guadeloupe.
permixtus Grouvelle. Guadeloupe.
ferrugineus Stephens. Guadeloupe.
bicolor Chevrolat. Cuba.
modestus Say. Guadeloupe.
chevrolati Grouvelle. Cuba.
exquisitus Grouvelle. Guadeloupe.
dufaui Grouvelle. Guadeloupe.
uncicornis Grouvelle. St. Vincent, Grenada, Grenadines, Mustique, Martinique, Guadeloupe, Porto Rico, Cuba.

Silvanus *Latreille.*

surinamensis Linné. Guadeloupe, Cuba.
var: *affinis* Chevrolat. Cuba.
angulicollis Reitter. Grenada.
trivialis Grouvelle. Guadeloupe, Grenada, St. Vincent.
unidentatus Olivier. Grenada.
triangulus Reitter. Grenada, St. Vincent, Guadeloupe.
planatus Germar. Guadeloupe.
signatus Frauenfeld. Grenada, St. Vincent, Mustique, Grenadines, Guadeloupe.

Ahasverus *Gozis.*

opaculus Leconte (*quadricollis* Reitter). Grenada, St. Vincent.
plagiatus Grouvelle. Guadeloupe.
humeralis Grouvelle. Guadeloupe.
advena Waltl. Grenada, Guadeloupe.
delauneyi Grouvelle. Guadeloupe.
?quadricollis Guérin. Grenada, St. Vincent.

Cathartus *Reiche.*

cassiæ Reiche (*gemellatus* Jacquelin Duval). Cosmopolitan. Grenada, St. Vincent, Cuba.

Nausibius *Redtenbacher.*

clavicornis Kugelann. St. Vincent.
dentatus Marsham. Guadeloupe, Cuba.

Lathropus *Erichson.*

costatus Grouvelle. Guadeloupe.

Cryptamorpha *Wollaston.*

musæ Wollaston. Grenada, St. Vincent.

Thione *Sharp.*

championi Sharp. Guadeloupe.

Dysmerus *Casey.*

sulcicollis Grouvelle. Guadeloupe.

Aprostomis *Grouvelle.*

cephalotes Grouvelle. Guadeloupe.

Note: *Bactridium* and *Europs* will be found in Monotomidæ.

Family XX. CRYPTOPHAGIDÆ.

Subfamily Telmatophilinæ.

Telmatoscius *Sharp.*

dufaui Grouvelle. Guadeloupe.

Cryptophilus *Reitter.*

frater Grouvelle. Guadeloupe.

Subfamily Cryptophaginæ.

Loberus *Leconte.*

vitraci Grouvelle. Guadeloupe.
discipennis Reitter. Grenada, St. Vincent.
insularis Casey. Cuba, Bahamas.
testaceus Reitter. Grenada, Grenadines, St. Vincent, Becquia, Guadeloupe, St. Thomas.

Platoberus *Sharp.*

latus Sharp. Guadeloupe.

Cryptophagus *Herbst.*

acutangulus Gyllenhal. Cuba.

Hapalips *Reitter.*

angulosus Grouvelle. Guadeloupe.
delauneyi Grouvelle. Guadeloupe.
sharpi Grouvelle. Guadeloupe.
guadalupensis Grouvelle. Guadeloupe.
dufaui Grouvelle. Guadeloupe.
filum Reitter. Grenada, Cuba.
sculpticollis Champion. Jamaica.
grouvellei Gorham. Grenada, St. Vincent.

Family XXI. TRITOMIDÆ.—formerly MYCETOPHAGIDÆ.

Typhæa *Stephens.*

fumata Linné. Grenada, St. Vincent, Guadeloupe.
semirufa Chevrolat. Cuba.

Litargus *Erichson.*

guadalupensis Grouvelle. Guadeloupe.
? balteatus Leconte. Antilles?

Berginus *Erichson.*

vitraci Grouvelle. Guadeloupe.
bahamicus Casey. Bahamas.
punctatolineatus Grouvelle. Martinique.

Family XXII. DERMESTIDÆ.

Dermestes *Linné.*

cadaverinus Fabricius (cosmopolitan). Cuba.
carnivorus Fabricius. Grenada, Guadeloupe, Cuba.
lardarius Linné. Cosmopolitan.
marmoratus Chevrolat. Cuba.
vulpinus Fabricius (cosmopolitan). Cuba.

Attagenus *Latreille.*

piceus Olivier var: *megatoma* Fabricius. Cuba.
cinnamomeus Roth. Cuba.

Globicornis *Latreille.*

fulvipes Guérin. Guadeloupe, Cuba.

Trogoderma *Latreille.*

bicinctum Reitter. Antilles.
insulare Chevrolat. Cuba.
subfasciatum Chevrolat. Cuba.

Anthrenus *Fabricius.*

verbasci Linné (*varius* Fabricius). Cosmopolitan.

Family XXIII. HISTERIDÆ.

Hypocaccus *Thomson.*

apricarius Erichson. St. Vincent.

Saprinus *Erichson.*

viator Marseul. Cuba.
tarnieri Marseul. Cuba.
sterquilinus Leconte. Cuba.
insularis Marseul. Guadeloupe.
guyanensis Marseul. Cuba.
fulgidus Leconte. Cuba.
cubæcola Marseul. Cuba.
cavalieri Marseul. Cuba.
æneicollis Marseul. St. Vincent.

Acritus *Leconte.*

strigipennis Bickhardt. Barbados.
poeyi Marseul. Cuba.
gulliver Marseul. Haiti, Cuba?
atomus Leconte. Cuba.
analis Leconte. Cuba.
sp.? Champion. Grenada, St. Vincent.

Bacanius *Leconte.*

scalptus Lewis. Cuba.

Idolia *Lewis.*

lævissima Leconte. Haiti, Cuba.

Paromalus *Erichson.*

parallelus Leconte. Cuba.

Isolomalus *Lewis.*

hispaniolæ Marseul. Grenada, St. Vincent, Cuba.
productus Marseul. Cuba.

Carcinops *Marseul.*

troglodytes Paykull. Grenada, St. Vincent, Haiti, Cuba.
parvula Leconte. Cuba.
dominicana Marseul. Haiti.
blandfordi Lewis. Jamaica.

Epierus *Erichson.*

waterhousei Marseul. Haiti.
smaragdinus Marseul. Cuba.
antillarum Marseul. Haiti, Porto Rico, Cuba.

Atholus *Thomson.*

confinis Erichson. Grenada, St. Vincent, Guadeloupe, Cuba.

Peranus *Lewis.*

bimaculatus Linné. Guadeloupe.

Hister *Linné.*

servus Erichson. Haiti, Cuba.
planiformis Lewis. Grenada.
cœnosus Erichson. Haiti, Cuba.

Omalodes *Erichson.*

soulouquei Marseul. Haiti.
simplex Lewis. Trinidad.
ruficlavis Marseul. Cuba.
lævinotus Marseul. Guadeloupe.
lævigatus Quensel. Haiti, Leeward Ids.
klugi Marseul. Cuba.
haitianus Marseul. Haiti.

Phelister *Marseul.*

rouzeti Fairmaire. St. Vincent.
riehli Marseul. Cuba.
hæmorrhous Marseul. Grenada, St. Vincent.

Teretrius *Erichson.*

rufulus Marseul. Antilles.
braganzæ Lewis. St. Thomas.

Trypanæus *Eschscholtz.*

luteivestis Marseul (*pallidipennis* Mars.). Guadeloupe, Cuba.

Oxysternus *Erichson.*

maximus Linné. Trinidad.

Lioderma *Marseul.*

quadridentatum Fabricius. Haiti, Jamaica.
rimosum Marseul. Cuba.
interruptum Marseul. Cuba.

Hololepta *Paykull.*

syntexis Lewis. St. Thomas.
cubensis Erichson. Haiti, Cuba.

Family XXIV. NITIDULIDÆ.

Smicrips *Leconte.*

exilis Murray. Grenada, St. Vincent, Guadeloupe.

Paralindria *Olliff.*

bipartita Olliff. Guadeloupe.

Pocadius *Erichson.*

helvolus Erichson (*ferrugineus* Chevrolat. Cuba. *brevis* Reitter). Cuba.

Pallodes *Erichson.*

translatus Grouvelle (*smithi* Grouvelle). Grenada.
ruficollis Reitter. St. Vincent (?), Cuba.
cyanescens Grouvelle. St. Vincent.

Camptodes *Erichson.*

foreli Grouvelle. Venezuela, Testigos.
sp. ? Champion. St. Vincent.

Lobiopa *Erichson.*

dimidiata Erichson. Testigos, Antilles.
insularis Castelnau (*decumana* Erichson). Guadeloupe, Grenada, St. Vincent, Cuba.

Stelidota *Erichson.*

cœnosa Erichson. Cuba.
strigosa Gyllenhal. Grenada, Grenadines, St. Vincent, Becquia, Guadeloupe.
ruderata Erichson. St. Thomas, St. John, Guadeloupe, Haiti, Cuba.
thoracica Kirsch. Guadeloupe.
geminata Say (*biseriata* Reitter). Grenada, St. Vincent, Guadeloupe, Cuba.
chontalensis Sharp. St. Vincent, Guadeloupe.
championi? Sharp. Grenada, Grenadines, St. Vincent, Mustique.

Haptoncus *Murray.*

luteolus Erichson. Grenada, St. Vincent, Guadeloupe, Cuba.

Conotelus *Erichson.*

conicus Fabricius. St. Vincent, Grenadines, Mustique, Becquia, Guadeloupe.
var: *fuscipennis* Erichson. Guadeloupe, Cuba.
stenoides Murray. St. Vincent.
spissicornis Fabricius (*obscurus* Er.). Cuba.
substriatus Erichson. Guadeloupe.

Cillæus *Castelnau.*

insularis Grouvelle. Haiti.
linearis Erichson. Guadeloupe.

Brachypeplus *Erichson.*

mutilatus Erichson. Grenada, St. Thomas.
anceps Murray. Grenada, St. Vincent.
tenuis Murray. St. Vincent, Guadeloupe.

Macrostola *Murray.*

straminea Murray var: *vitraci* Grouvelle. Guadeloupe.
lutea Murray. St. Vincent.

Carpophilus *Stephens.*

dufaui Grouvelle. Guadeloupe.
vitraci Grouvelle. Guadeloupe.
hemipterus Linné. Grenada, St. Vincent, Guadeloupe, Cuba.
dimidiatus Fabricius. Grenada, Guadeloupe, Cuba, Bahamas.
var. *ochropterus* Murray. Cuba.
var. *mutilatus* Erichson. Grenada, Guadeloupe, Cuba.
var. *luridus* Murray. Cosmopolitan.
ovatus Grouvelle. Guadeloupe.
pallipennis Say. Bahamas.
tempestivus Erichson. Cuba.

Colopterus *Er.* (**Colastus** *Erichson*).

triangularis Murray. Grenada, St. Vincent, Guadeloupe.
ruptus Fabricius. Grenada, St. Vincent, Guadeloupe.
amputatus Erichson. Guadeloupe, Porto Rico, Cuba.
truncatus Randall. Guadeloupe, Porto Rico.

Brachypterus *Erichson.*

insularis Grouvelle. Trinidad, Grenada.

Mystrops *Erichson.*

dufaui Grouvelle. Guadeloupe.
insularis Grouvelle. Antilles.

Amphicrossus *Erichson.*

insularis Grouvelle. St. Thomas.

Rhizophagus *Herbst.*

keydeni Reitter. Cuba.
cubensis Chevrolat. Cuba.

Family XXV. LATHRIDIIDÆ.

Melanophthalma *Motschulsky.*

signata Belon. Cuba.

Corticaria *Marsham.*

flavicula Motschulsky. Cuba.

Lathridius *Herbst.*

seminiveus Motschulsky. Cuba.

Lobogestoria *Reitter.*

gibbicollis Reitter. Cuba.

Derolathrus *Sharp.*

sharpi Grouvelle. Guadeloupe.

Family XXVI. THORICTIDÆ.

Thorictodes *Reitter.*

heydeni Reitter. Guadeloupe.

Family XXVII. TEMNOCHILIDÆ (formerly TROGOSITIDÆ).

Calanthosoma *Reitter.*

flavomaculatum Reitter. Antilles.

Nemosoma *Reitter.*

landesi Léveillé. Martinique.

Airora *Reitter.*

striatopunctata Reitter. Antilles.

Temnochila *Erichson.*

ænea Olivier. Porto Rico.
borrei Reitter. Antilles.
ebenina Blanchard. Grenadines, Mustique.
insignis Reitter. Antilles.
obscura Reitter. Guadeloupe?
parva Léveillé. Haiti.
patricioi Karsch. St. Thomas?
portoricensis Léveillé. Porto Rico.
sulcisternum Léveillé. Jamaica.

Tenebroides *Piller and Mitterpacher.*

bipustulatus Fabricius. Antilles.
elongatulus Jacquelin Duval. Cuba.
flaviclavis Reitter. Cuba.
mauritanicus Linné. (Cosmopolitan). Guadeloupe.
punctulatus Reitter. Guadeloupe, Porto Rico, Cuba.
sonorensis Sharp. Cuba.
soror Jacquelin Duval. Cuba.
?steinheili Reitter. Grenadines, Mustique.
sulcifrons Jacquelin Duval. Cuba.
transversicollis Jacquelin Duval. Guadeloupe, Cuba.

Colydobius *Sharp.*

dufaui Léveillé. Guadeloupe.

Lophocateres *Olliff.*

pusillus Klug. Guadeloupe.

Family XXVIII. MONOTOMIDÆ.

Bactridium *Leconte.*

adustum Reitter. Guadeloupe.
exiguum Grouvelle. Guadeloupe.
sp. *near adustum* Champion. Grenada, St. Vincent.

Europs *Wollaston.*

maculatus Grouvelle. Haiti.
maculatus var: Champion. St. Vincent.
? lineellus Reitter. Grenada, St. Vincent.
sp. near *rhizophagoides* Champion. Grenada, St. Vincent.
fallax Grouvelle. Guadeloupe.
foveicollis Grouvelle. Guadeloupe.
zonatus Grouvelle. Guadeloupe, Martinique.
rhizophagoides Reitter var: *apicalis* Reitter. Guadeloupe, Jamaica.
rhizophagoides Reitter. Martinique.

Monotoma *Herbst.*

parallela Leconte. Guadeloupe, Grenada
?pinicollis Aubé. Guadeloupe, Grenada, St. Vincent.
americana Aubé. Grenada, St. Vincent.
picipes Herbst (*foveata* Lec.). Guadeloupe, Grenada, St. Vincent.

Family XXIX. BYRRHIDÆ.

Nosodendron *Latreille.*

punctatostriatum Chevrolat. Guadeloupe, Cuba.
cribratum Castelnau. Guadeloupe.

Chelonarium *Fabricius.*

beauvoisi Latreille. Haiti.
pilosellum Chevrolat. Guadeloupe.
punctatum Fabricius. Cuba.

Family XXX. DRYOPIDÆ.

(formerly PARNIDÆ).

Helmis *Latreille.*

smithi Grouvelle. Grenada.

Pelonomus *Erichson.*

picipes Olivier. Guadeloupe.
insularis Grouvelle. Haiti.
gracilipes Chevrolat. Cuba.

Lutrochus *Erichson.*

geniculatus Chevrolat. Cuba.

Phanocerus *Sharp.*

congener Grouvelle. Grenada.
hubbardi Schæffer. Jamaica.

Hexanchorus *Sharp.*

caraibus Coquerel. Guadeloupe.

Xexanchorinus *Grouvelle.*

latus Grouvelle. Grenada.

Psephenops *Grouvelle.*

smithi Grouvelle. Grenada, St. Vincent.

Family XXXI. HETEROCERIDÆ.

Heterocerus *Fabricius.*

varius Kiesenwetter. St. Thomas.
pumilio Kiesenwetter. St. Thomas.
lituratus Kiesenwetter. Antilles.
guttatus Kiesenwetter. Cuba.
decemmaculatus Chevrolat. Cuba.
bilineatus Chevrolat. Cuba.
angustatus Chevrolat. Cuba.

Family XXXII. HELODIDÆ (CYPHONIDÆ)

formerly included with DASCILLIDÆ.

Cyphon *Paykull.*

dehiscens Champion. St. Vincent.
caraibus Champion. St. Vincent.

Prionoscirtes *Champion.*

dilaticornis Champion. St. Vincent.

Scirtes *Illiger.*

apicalis Chevrolat. Cuba.
cinctipennis Chevrolat. Cuba.
testaceus Fabricius. Guadeloupe.
fuscus Chevrolat. Cuba.
pilatei Guérin. Grenada.
angustatus Champion. Grenada.
insularis Champion. St. Vincent.
suborbiculatus Champion. Grenada.
salicis Champion. St. Vincent.

Ptilodactyla *Illiger.*

annulicornis Chevrolat. Cuba.
carbonaria Chevrolat. Cuba.
emarginata Chevrolat. Cuba.
militaris Chevrolat. Cuba.
ramicornis Chevrolat. Cuba.
simplex Chevrolat. Cuba.
antillarum Champion.. St. Vincent.
humerosa Champion. St. Vincent.
sancti-vincentis Champion. St. Vincent.

Helodes *Latreille.*

xanthurus Chevrolat. Cuba.
angustatus Chevrolat. Cuba.

Ora *Clark.*

interruptus Chevrolat. Cuba.
sexlineatus Chevrolat. Cuba.

Family XXXIII. DASCILLIDÆ.

Cneoglossa *Guerin.*

sp.? Champion. St. Vincent.

Family XXXIV. RHYNCERIDÆ

(formerly RHIPIDOCERIDÆ).

Callirrhipis *Latreille.*

insularis Castelnau. Guadeloupe.
lacordairei Castelnau. Guadeloupe.
lherminieri Castelnau. St. Vincent, Guadeloupe.

Family XXXV. EUCNEMIDÆ.

Tharops *Castelnau.*

picteti Bonvouloir. Guadeloupe.

Dromæolus *Kiesenwetter.*

fastidiosus Bonvouloir (*delauneyi* Fleut.). Guadeloupe.
ischiodontoides Chevrolat. Cuba.
palpalis Fleutiaux. Guadeloupe.
subcylindricus Fleutiaux. Guadeloupe.

Fornax *Castelnau.*

adjectus Horn. Guadeloupe.
colonus Fleutiaux. Guadeloupe.
ebeninus Fleutiaux. Cuba.
insitus Horn. Guadeloupe.
infrequens Bonvouloir (*guadelupensis* Fleut.). Guadeloupe.
luridus Chevrolat. Cuba.
repulsus Chevrolat. Cuba.

Plesiofornax *Bonvouloir.*

dufaui Fleutiaux. Guadeloupe.

Entomophthalmus *Bonvouloir.*

americanus Bonvouloir. Guadeloupe.

Microrhagus *Eschcholtz.*

pyrrhopus Chevrolat. Cuba.

Adelothyreus *Bonvouloir.*

bonvouloiri Fleutiaux. Guadeloupe.
curtus Fleutiaux. Guadeloupe.
dufaui Fleutiaux. Guadeloupe.
mouffleti Bonvouloir. Guadeloupe.
quadrimaculatus Chevrolat. Cuba.

Arrhipis *Bonvouloir.*

lanieri Guérin. Porto Rico, Cuba.
var: *jacquelinii* Chevrolat. Cuba.

Emathion *Castelnau.*

leprieuri Castelnau. Cuba.

Nematodes *Latreille.*

biimpressus Fleutiaux. Guadeloupe.
guadeloupensis Fleutiaux. Guadeloupe.
rugicollis Chevrolat. Cuba.
simulans Chevrolat. Cuba.

Dendrocharis *Guérin.*

bombycinus Guérin. Cuba.

Rhagomicrus *Fleutiaux.*

solitarius Fleutiaux. Guadeloupe.

Family XXXVI. ELATERIDÆ.

Adelocera *Latreille.*

modesta Boisduval var: *guadeloupensis* Fleutiaux. Guadeloupe, Martinique.

subcostata Candèze. Guadeloupe, Cuba.

Meristhus *Candèze.*

setarius Chevrolat. Cuba.

scobinula Candèze. Cuba.

Alaus *Eschscholtz.*

oculatus Linné var: *luscus* Fabricius. Cuba.

Calais *Castelnau.*

nobilis Sallé. Haiti.
patricia Candèze. Cuba.
primaria Candèze. Cuba.
tricolor Olivier. Haiti.

Hemirhipus *Latreille.*

fascicularis Fabricius. Cuba.
viduus Chevrolat. Cuba.

Chalcolepidius *Eschscholtz.*

obscurus Castelnau. Trinidad, Guadeloupe.
silbermanni Chevrolat. St. Vincent, Jamaica.
sulcatus Fabricius. Guadeloupe (?) Martinique.
virens Fabricius. Grenada.

Semiotus *Eschscholtz.*

ligneus Linné. Grenada.

Anoplischius *Candèze.*

depressipennis Candèze. Cuba.
punctatus Candèze. Haiti.
pyronotus Candèze. Cuba.
ruficeps Candèze. Cuba.
sagranianus Jacquelin Duval. Cuba.
sulcifrons Candèze. Guadeloupe.
venustus Jacquelin Duval. Cuba.

Crepidius *Candèze.*

flavipes Champion. St. Vincent.
rhipiphorus Candèze. Guadeloupe.

Ischiodontus *Candèze.*

antennatus Candèze. Cuba.
aper Candèze. Haiti.
brunneus Fleutiaux. Guadeloupe.
convexus Fleutiaux. Guadeloupe.
separatus Fleutiaux. Martinique, Guadeloupe.
inornatus Candèze. Grenada, Grenadines, Mustique, St. Vincent, Martinique, Guadeloupe.
oblitus Dejean. Cuba.
striatus Candèze. Cuba.

Dicrepidius *Eschscholtz.*

?cavifrons Candèze. Guadeloupe.
distinctus Fleutiaux. Guadeloupe.
ilegans Fleutiaux. Guadeloupe.
notus Fleutiaux. Guadeloupe.
insularis Champion. Grenada, St. Vincent.
ramicornis Beauvois. Guadeloupe, Cuba.

Eudactylus *Sallé.*

cyanipennis Candèze. Cuba.
latus Fleutiaux. Haiti.
schaumi Candèze. Cuba.
wapleri Sallé. Haiti.

Conoderus *Eschscholtz.*

bellus Say. Haiti.
bifoveatus Beauvois. Cuba.
var: *castanipes* Germar. Guadeloupe, Haiti.
castaneus Fabricius. Guadeloupe.
var: *delauneyi* Fleutiaux. Martinique.
curvifrons Candèze. Haiti.
dorsalis Say. Cuba.
lividus DeGeer. Bahamas, Haiti, Cuba.
memorabilis Candèze. Martinique, Cuba.
parallelus Candèze. Cuba.
pinguis Candèze. Cuba.
posticus Eschscholtz. Grenada, St. Vincent.
var: *sticturus* Candèze. Guadeloupe, Cuba.
rufidens Fabricius. Guadeloupe.
sericatus Chevrolat. Haiti, Cuba.
substriatus Candèze. Haiti.
vitraci Fleutiaux. Guadeloupe.

Aeolus *Eschscholtz.*

binotatus Candèze. Cuba.
cibœnsis Candèze. Haiti.
depressus Candèze. Haiti.
discicollis Candèze. Cuba.
elegans Fabricius. Cuba.
frivolus Candèze. Haiti.
maculatus DeGeer. Haiti, Cuba.
melliculus Candèze. Grenada, Guadeloupe.
var: *rubricatus* Candèze. Grenada.
nigromaculatus Drapiez. Grenada, Grenadines, Mustique.
verruculosus Candèze. Haiti.

Heteroderes *Latreille.*

amplicollis Gyllenhal. Guadeloupe, Martinique, Cuba.
laurenti Guérin. Grenada, Grenadines, St. Vincent, Mustique.

Megapenthes *Kiesenwetter.*

opaculus Candèze. Cuba.
tæniatus Candèze. Cuba.

Physorhinus *Eschscholtz.*

erythrocephalus Fabricius. Grenadines, Mustique, Becquia.
insularis Candèze. Guadeloupe.

Anchastus *Leconte.*

insularis Candèze. Martinique.
jamaicæ Candèze. Jamaica.
moratus Candèze. Grenada.
rufescens Dejean. Cuba.
rufiventris Candèze. Cuba.
terminatus Candèze. Guadeloupe.

Anchastomorphus *Champion.*

phedrus Candèze. Grenada.
?var: *crux-nigra* Fleutiaux. Antilles?
var: *grouvellei* Fleutiaux. Haiti.
dufaui Fleutiaux. Guadeloupe.

Agrypnella *Champion.*

squamifer Candèze (*pictus* O. Schwarz) Grenada.

Horistonotus *Candèze.*

asthenicus Candèze. Haiti.
var: *sallei* Fleutiaux. Guadeloupe, Cuba.
badius Candèze. Cuba.
bignoniæ Candèze. Haiti.
cruxnigra Chevrolat. Cuba.
sericeus Champion. St. Vincent.

Esthesopus *Candèze.*

grenadensis Champion. Grenada, Guadeloupe.
hepaticus Erichson. Cuba.
humilis Candèze. Cuba.
paedicus Candèze. Guadeloupe, Cuba.

Pyrophorus *Illiger.*

?cucujus Illiger. Antilles.
havaniensis Castelnau. Cuba.
hesperus Candèze. Cuba.
longipennis O. Schwarz. Cuba.
luminosus Illiger. Porto Rico.
lychniferus Germar. Cuba.
lychnus Candèze. Haiti, Cuba.
noctilucus Linné. Guadeloupe, St. Vincent, Jamaica, Haiti, Cuba.
pellucens Eschscholtz. Trinidad, Antilles (?).
plagiophthalmus Germar. Jamaica.
sp. ? Bahamas.

Hemicrepidius *Germar.*

pictipes Chevrolat. Antilles.

Trichophorus *Mulsant.*

havaniensis Candèze. Cuba.
sturmi Germar. Guadeloupe (?). Cuba.

Cosmesus *Eschscholtz.*

flavidus Candèze. St. Vincent.

Agriotes *Eschscholtz.*

guadalupensis Candèze. Guadeloupe.

Monelasmus *Candèze.*

insularis Candèze. Martinique.

Glyphonyx *Candèze.*

bivittatus Candèze. Haiti.
fusculus Erichson. Haiti, Cuba.
gundlachi Candèze. Cuba.
praevius Erichson. Haiti.
quadraticollis Champion. Antigua.
recticollis Say. Cuba.
scabriusculus Chevrolat. Cuba.

Family XXXVII. TRIXAGIDÆ
(formerly THROSCIDÆ).

Aulonothroscus *Horn.*

bicarinatus Fleutiaux. Guadeloupe.

Drapetes *Redtenbacher.*

sellatus Bonvouloir. Guadeloupe.
mediorufus Fleutiaux. Guadeloupe.
nigricans Bonvouloir. Guadeloupe.
tunicatus Bonvouloir. Cuba.
nigripennis Jacquelin Duval. Cuba.
chalybeus Gerstaecker. Porto Rico.
bicolor Castelnau. Cuba.
azureus Jacquelin Duval. Cuba.

Lissomus *Dalman.*

punctulatus Dalman (*impressifrons* Fleut.). Guadeloupe.

Family XXXVIII. BUPRESTIDÆ.

Polycesta *Solier.*

cyanipes Fabricius. Jamaica.
angulosa Jacquelin Duval. Cuba.
chevrolatii Thomson. Cuba.
cubæ Chevrolat. Cuba.
depressa Linné. Guadeloupe, Jamaica.
goryi Saunders. Antilles.
gossei Waterhouse. Jamaica.
olivieri Waterhouse. Jamaica.
porcata Fabricius. Haiti.
regularis Waterhouse. Dominica.
thomæ Chevrolat. St. Thomas.

Acmaeodera *Eschscholtz.*

contigua Kerremans. Guadeloupe.
cruenta Olivier. Antilles.
cubæcola Jacquelin Duval. Cuba.
flavomarginata Gray. Guadeloupe.
marginenotata Chevrolat. Cuba.
pulcherrima Jacquelin Duval. Cuba.

Chrysesthes *Solier.*

lanieri Chevrolat. Cuba.

Halecia *Castelnau.*

aureomicans Nonfried. Haiti.
erythropus Gory. Guadeloupe.
nitidicollis Castelnau. Haiti.
pyrhopus Kerremans. Guadeloupe.
quadricolor Chevrolat. Cuba.
verecunda Chevrolat. Cuba.

Gyascutus *Leconte.*

carolinensis Horn. Bahamas.

Chalcophora *Solier.*

humboldti Castelnau. Guadeloupe.

Hilarotes *Thomson.*

chalcoptera Jacquelin Duval. Cuba.
mannerheimi Mannerheim. Haiti.

Psiloptera *Solier.*

aurata Saunders (*aurifer* || Castelnau). Haiti, Cuba.
guildingi Castelnau. St. Vincent.
straba Chevrolat. Cuba.
torquata Dalman. Jamaica, Cuba.

Dicerca *Eschscholtz.*

tuberculata Chevrolat. Cuba.

Cinyra *Castelnau.*

albonotata Castelnau. Haiti.
costulifera Chevrolat. Cuba.
multipunctata Olivier. Cuba.
sulcicollis Chevrolat. Cuba.

Buprestis *Linné.*

decora Olivier. Cuba.
fasciata Fabricius (*lherminieri* Chev.). Guadeloupe.
lineata Fabricius. Cuba.
maura Olivier. Haiti.

Peronæmis *Waterhouse.*

thoracicus Waterhouse. Jamaica.

Aglaostola *Thomson.*

teretricollis Pallas. Jamaica.

Melanophila *Eschscholtz.*

acuminata DeGeer (*longipes* Say). Cuba.
notata Laporte & Gory. Isle of Pines.

Tetragonoschema *Thomson.*

quadratum Buquet. Haiti.

Anthaxia *Eschscholtz.*

subsinuata Gory. Cuba.

Chrysobothris *Eschscholtz.*

chlorosticta Thomson. Haiti.
lepida Castelnau. Cuba.
megacephala Castelnau. Haiti.
rotundicollis Castelnau. Haiti.
thomae Kerremans. St. Thomas.
thoracica Fabricius. St. Thomas.
tranquebarica Gmelin (*impressa* Fab.). Guadeloupe, Cuba.
tumida Chevrolat. Cuba.

Actenodes *Lacordaire.*

bellula Mannerheim. Cuba.
var: *sobrina* Mannerheim (*auronotata* Cast.). Haiti, Cuba.
fulminata Schönherr (*cyanura* Chev.) Martinique.

Paradomorphus *Waterhouse.*

albicollis Waterhouse. Jamaica.

Agrilus *Stephens.*

denticornis Chevrolat. Cuba.
dominicanus Thomson. Haiti.

Lius *Eschscholtz.*

guadeloupensis Reiche. Guadeloupe.

Taphrocerus *Solier.*

laesicollis Chevrolat. Cuba.
timidus Chevrolat. Cuba.

Leiopleura *Deyrolle.*

compactilis Chevrolat. Cuba.

Mastogenius *Solier.*

uniformis Waterhouse. Grenada.

Family XXXIX. LYCIDÆ.

Plateros *Bourgeois.*

fraternus Gorham. St. Vincent.
palliatus Gorham. St. Vincent.

Calopteron *Guérin.*

semiflavum Chevrolat. Cuba.
smithi Gorham. St. Vincent.
delicatum Kirsch. Grenada.
oblitum Gorham. Grenada, St. Vincent.
pectinicorne Chevrolat. Guadeloupe, Cuba.
elegantulum Jacquelin Duval. Cuba.
aulicum Jacquelin Duval. Cuba.
nigritarse Chevrolat. Cuba.
distinguendum Jacquelin Duval. Cuba.
amabile Jacquelin Duval. Cuba.
suave Jacquelin Duval. Cuba.
bicolor Linné. Guadeloupe, Haiti, Jamaica, Cuba.

Thonalmus *Bourgeois.*

chevrolatii Bourgeois (= *bicolor* Chevrolat). Haiti.
militaris Dalman. Jamaica.
dominicensis Chevrolat. Guadeloupe, Haiti.

Family XL. LAMPYRIDÆ.

Alecton *Castelnau.*

discoidalis Laporte. Cuba.
var: *improvisus* E. Olivier. Cuba.

Lucidota *Castelnau.*

minuta Leconte. Grenada, St. Vincent.

Lychnuris *E. Olivier.*

adjuncta E. Olivier. Cuba.
bellicosa E. Olivier. Cuba.
demissa E. Olivier. Cuba.
flavilabris E. Olivier. Cuba.
janthinipennis Jacquelin Duval. Cuba.
militaris E. Olivier. Cuba.
miniatocollis Chevrolat. Cuba.
postica E. Olivier. Haiti.
rufa Olivier (*dimidiatipennis* Jacq. Duval.) Haiti, Cuba.

Cratamorphus *Motschulsky.*

dorsalis Gyllenhal. St. Bartholomew.

Aspisoma *Castelnau.*

superciliosum Gorham. Grenada, St. Vincent, Grenadines.
rotundum E. Olivier. St. Croix.
ignitum Linné. Grenada, St. Vincent, Grenadines, Union, Mustique.

Lecontea *E. Olivier.*

galeata E. Olivier. St. Thomas, Porto Rico.
gamma Jacquelin Duval. Cuba.
vitticollis Motschulsky. Haiti.

Macrolampsis *Motschulsky.*

perelegans Gorham. Antigua.

Heterophotinus *E. Olivier.*

limbipennis Jacquelin Duval. Cuba.

Photinus *Lacordaire.*

albicollis Chevrolat. Cuba.
apoplecticus E. Olivier. Cuba.
blandus Motschulsky. Haiti, Cuba.
commissus E. Olivier. Jamaica.
contemptus E. Olivier. Jamaica.
decorus E. Olivier. Haiti, Porto Rico.
discoideus Sahlberg. Guadeloupe.
divisus Gemminger & Harold. Antilles.
ebriosus E. Olivier. Jamaica.
elongatus Motschulsky. Antilles.
fulgidus Olivier. Haiti.
glaucus Olivier. Haiti.
littoralis Motschulsky. Martinique.
maritimus E. Olivier. Jamaica.
opulentus E. Olivier. Jamaica.
pallens Browne. Jamaica.
pantoni E. Olivier. Jamaica.
pygmœus E. Olivier. Cuba.
quadrimaculatus Castelnau. St. Vincent, Haiti.
quinquenotatus Castelnau. Haiti.
sanctus E. Olivier. St. Thomas.
suavis E. Olivier. Jamaica.
triangularis E. Olivier. Porto Rico.
vittatus Olivier. Guadeloupe, Haiti.
vitiosus Gemminger. Guadeloupe.
vittiger Gyllenhal. Martinique.

Photuris *Leconte.*

brunnipennis Jacquelin Duval. Cuba.
jamaicensis E. Olivier. Jamaica.

Phengodes *Illiger.*

pulchellus Guérin. Tobago.

Family XLI. TELEPHORIDÆ.

Lobetus *Kiesenwetter.*

guadeloupensis Fleutiaux. Guadeloupe.

Silis *Latreille.*

tenella Gorham. St. Vincent.
marginella Jacquelin Duval. Cuba.

Telephorus *Schaeffer.*

cinctipennis Fleutiaux. Guadeloupe.
maculicornis Fleutiaux. Guadeloupe.

Tylocerus *Dalman.*

crassicornis Dalman. St. Bartholomew, Jamaica.
lineatus Gorham. Grenada, St. Vincent.

Chauliognathus *Hentz.*

marginatus Fabricius. Bahamas.

Family XLII. MALACHIDÆ.

Ebæus *Erichson.*

?minimus Erichson. Grenada.
nigrocoeruleus Gorham. St. Vincent.
?seminulum Erichson. Grenada, Grenadines.

Astylus *Castelnau.*

antillarum Gorham. St. Vincent.

Anthocomus *Erichson.*

dimidiatus Erichson. Cuba.

Collops *Erichson.*

ludicrus Erichson. Haiti.

Family XLIII. CLERIDÆ.

Monophylla *Spinola.*

cinctipennis Chevrolat. Cuba.

Thanoclerus *Lefebvre.*

girodi Chevrolat. Cuba.

Aulicus *Spinola.*

basicollis Chevrolat. Cuba.
alboguttulatus Chevrolat. Cuba.
bilineatus Chevrolat. Cuba.

Epiphlœus *Spinola.*

nebulosus Chevrolat. Cuba.
quadristigma Chevrolat. Cuba.
quattuordecimmaculatus Chevrolat. Cuba.

Orthopleura *Spinola.*

lepida Klug. Cuba.
damicornis Fabricius. Cuba.
punctatissima Chevrolat. Cuba.

Galeruclerus *Gahan.*

insularis Gorham. St. Vincent.
piciventris Chevrolat. Cuba.

Pelonium *Spinola.*

murinum Klug. Haiti.
subfasciatum Chevrolat. Guadeloupe.
velutinum Klug. Haiti.

Tarsostenus *Spinola.*

univittatus Rossi. Cosmopolitan.

Corynetes *Herbst.*

cæruleus DeGeer. Cosmopolitan.

Necrobia *Olivier.*

ruficollis Fabricius. Cosmopolitan. Cuba.
violacea Linné. Cosmopolitan.
rufipes DeGeer. Cosmopolitan, Cuba.

Family XLIV. PTINIDÆ.

Gibbium *Scopoli.*

æquinoctiale Boieldieu (*chevrolatii* Boield.). Cuba.
psyllioides Czempinski (*scotias* Fab.). St. Vincent.

Ptinus *Linné.*

fur Linné. Cosmopolitan.
dufaui Pic. Guadeloupe.
niveicollis Boieldieu. Haiti.
tessellatus Gorham. Grenadines.

Scymnuseutheca *Pic.*

apicalis Pic. Guadeloupe.

Ozognathus *Leconte.*

exiguus Gorham. St. Vincent.

Sitodrepa *C. G. Thomson.*

panicea Linné. (Cosmopolitan), Guadeloupe.

Xyletinus *Latreille.*

castaneus Castelnau. Antilles.
marmoratus Pic. Guadeloupe.

Lasioderma *Stephens.*

serricorne Fabricius, (Cosmopolitan), Grenada, Guadeloupe.
puberulum Gorham. St. Vincent, Grenada, Grenadines.

Petalium *Leconte.*

antillarum Pic. Grenadines.
pulicarium Gorham. Grenada, Grenadines.
var: *dufaui* Pic. Guadeloupe.
fauveli Pic. Guadeloupe.
punctatum Pic. Guadeloupe.

Pseudodorcatoma *Pic.*

dufaui Pic. Guadeloupe.
var: *minuta* Pic. Guadeloupe.
ornata Pic. Guadeloupe.
sericea Pic. Guadeloupe.
var: *semirufa* Pic. Guadeloupe.

Leptobia *Fauvel.*

guadalupensis Pic. Guadeloupe.
var: *subnitida* Pic. Guadeloupe.

Calymmaderus *Solier.*

bibliothecarum Poey. Guadeloupe, Cuba.
brevissimus Pic. Guadeloupe.
dufaui Pic. Guadeloupe.
testaceipes Pic. Cuba.

Mirosternus *Sharp.*

lævis Gorham. St. Vincent.

Catorama *Guérin.*

herbarium Gorham. Grenada, St. Vincent.
dufaui Pic. Guadeloupe.
holosericea Pic. Grenada.
palmarum Guérin. Haiti.
sallei Guérin. Guadeloupe, Haiti.
tabaci Guérin. Cuba.
zeæ Waterhouse. Barbados.

Priotoma *Gorham.*

?brevis Gorham. St. Vincent.

Dorcatoma *Herbst.*

castanea Gyllenhal. St. Bartholomew.

Xylographus *Mellié.*

suillus Gorham. Guatemala, St. Vincent.

Atractocerus *Latreille.*

brasiliensis Laporte. Porto Rico, Cuba.

Family XLV. BOSTRYCHIDÆ.

Lyctus *Fabricius.*

prostomoides Gorham. Grenada, St. Vincent.

Xylopertha *Guérin.*

sextuberculata Leconte. Grenada.
minuta Fabricius. Haiti.

Heterarthron *Guérin.*

femoralis Fabricius. St. Croix, Cuba.
caribeanus Lesne. Trinidad, Guadeloupe.
jamaicensis Lesne. Jamaica.
gonagra Fabricius. St. Thomas, St. Bartholomew, Mona, Guadeloupe. Haiti, Cuba.

Dinoderus *Stephens.*

brevis Horn. Jamaica.
bifoveatus Wollaston. Grenada, St. Vincent, Guadeloupe, Haiti.
distinctus Lesne (imported from Phillipines). Guadeloupe.

Bostrychus *Geoffroy.*

puncticollis Kiesenwetter. Antilles?
bicornutus Latreille. Guadeloupe.

Bostrychulus *Lesne.*

fuscus Lesne. Cuba.

Schistoceros *Lesne.*

hamatus Fabricius (*bicaudatus* Say). Cuba?

Tetrapriocera *Horn.*

tridens Fabricius (*longicornis* Oliv., *schwarzi* Horn). Grenada, St. Thomas, Haiti, Porto Rico, Cuba.

Xylobiops *Casey.*

?texanus Horn. Jamaica.
floridanus Horn. Jamaica.

Xylomeira *Lesne.*

torquata Fabricius. Grenada, St. Lucia, Antigua, St. Thomas, Guadeloupe, Porto Rico, Haiti, Cuba.

Dendrobiella *Casey.*

sublævis Casey. Jamaica, Haiti, Cuba.

Rhizopertha *Stephens.*

pusilla Fabricius. Antilles.

Apate *Fabricius.*

francisca Fabricius (*carmelita* Fab.). Cuba.
muricata Fabricius. Jamaica.

Family XLVI. CIOIDÆ.

Cis *Latreille.*

pusillus Gorham. Grenadines.
bipartitus Jacquelin Duval. Cuba.
hirtellus Jacquelin Duval. Cuba.
melliei Coquerel. Martinique.
murinus Mellié. Cuba.
nubilus Gorham. St. Vincent.
puberulus Mellié. Guadeloupe, St. Thomas.
superbus Kraus. Cuba.

Ennearthron *Mellié.*

taurulus Jacquelin Duval. Cuba.
annulatum Kraus. Cuba.
curtum Mellié. Cuba.
delicatulum Jacquelin Duval. Cuba.
multipunctatum Mellié. Cuba.

Ceracis *Mellié.*

bifurcus Gorham. St. Vincent.
bison Reitter. Cuba.
furcifer Mellié. St. Vincent.
unicornis Gorham. St. Vincent.
tricornis Gorham. St. Vincent.
militaris Mellié. St. Vincent.

Ceratocis *Mellié.*

castaneipennis Mellié. Cuba.
variabilis Mellié. Cuba.

Family XLVII. SPHINDIDÆ.

Sphindus *Chevrolat.*

dubius Gyllenhal. Grenada.

Family XLVIII. PASSALIDÆ.

Neleus *Kaup.*

interstitialis Eschscholtz. Trinidad, Tobago, Grenada, Jamaica, Cuba.
distinctus Kuwert. Cuba.
suturalis Burmeister. Cuba.

Paxillus *MacLeay.*

consobrinus Kuwert. Antilles.
pentaphyllus Beauvois. Cuba?, Antilles.

Pertinax *Kaup.*

pertyi Kaup. Haiti, Cuba.

Pertinacides *Kuwert.*

affinis Percheron. Haiti, Cuba.

Phoroneus *Kaup.*

occipitalis Percheron. Cuba.

Epiphanus *Kaup.*

abortivus Percheron. Guadeloupe.

Petrejus *Kaup.*

mucronatus Burmeister. Antilles.

Ninus *Kaup.*

carbonarius Sturm. Cuba.
barbatus Serville. Jamaica, Cuba.
honduræ Kuwert. Jamaica

Neleides *Kaup.*

antillarum Arrow. Grenada.

Morosophus *Kuwert.*

cubanus Kuwert. Cuba.

Ptychotrichus *Kuwert.*

geometricus Percheron. Antilles.
sulciscutellum Kuwert. Antilles.
crinicicatrix Kuwert. Haiti.

Passalus *Fabricius.*

tlascala Percheron. Trinidad, Grenada, St. Vincent.
interruptus Linné. Tobago, Antilles.
unicornis Serville. Dominica, St. Lucia, Guadeloupe, Cuba
?convexus Dalman. Cuba.

Verroides *Kuwert.*

fuscilabris Eschscholtz. Trinidad.

Spasalus *Kaup.*

puncticollis Serville. Dominica, St. Lucia, Nevis, Guadeloupe, Porto Rico.
robustus Percheron. Guadeloupe.

Family XLIX. SCARABÆIDÆ.

Canthon *Hoffmansegg.*

chlorizans Bates. Mustique, Union.
acutus Harold. St. Thomas.
callosus Harold. Haiti.
gundlachi Harold. Cuba.
histeroides Harold. Cuba.
pygmaeus Harold. Cuba.
signifer Harold. Haiti.
violaceus Olivier. Haiti.
vitraci Fleutiaux. Guadeloupe.

Uroxys *Westwood.*

vincentiae Arrow. St. Vincent.

Chœridium *Serville.*

illæsum Harold. Grenada, St. Vincent, Mustique.
insulare Chevrolat. Guadeloupe.

Pinotus *Erichson.*

triangulariceps Blanchard. St. Croix?

Phanæus *MacLeay.*

jasius Olivier (= *abas* MacLeay). Trinidad.
sulcatus Drury. Jamaica.

Onthophagus *Latreille.*

albicornis Beauvois. Haiti.
antillarum Arrow. Grenada, St. Vincent.
marginatus Castelnau. Cuba.
femoralis Kirsch. Guadeloupe.

Oniticellus *Ziegler.*

cubiensis Castelnau. Jamaica, Cuba.

Subfamily Aphodiinæ.

Aphodius *Illiger.*

cuniculus Chevrolat. Grenada, St. Vincent, Mustique, Haiti, Cuba.
granarius Linne var: *guadeloupensis.* Fleutiaux, Guadeloupe.
luridus Fabricius. Grenada.
lividus Olivier (cosmopolitan). Haiti, Cuba.
quadridentatus Harold. Cuba.

Atænius *Harold.*

capitosus Harold. St. Thomas, Antilles.
elongatus Beauvois. Guadeloupe, Haiti.
exaratus Fleutiaux & Sallé. Guadeloupe.
frater Arrow. Grenada, St. Vincent.
gracilis Melsheimer. Grenada, St. Vincent, Guadeloupe, Porto Rico, Cuba.
imbricatus Melsheimer (= *sordidus* Harold). Cuba.
picipes Fleutiaux & Sallé. Guadeloupe.
polyglyptus Bates. Grenada, St. Vincent.
species near *polyglyptus.* Mustique.
rhyticephalus Chevrolat. Cuba.
scutellaris Harold. Antilles.
stercorator Fabricius. Gaudeloupe, Cuba.
strigicauda Bates. Grenada, St. Vincent, St. Thomas, Becquia.
sulcatulus Chevrolat. Guadeloupe, Cuba.
tenebrosus Arrow. Trinidad, Grenada.
terminalis Chevrolat. Grenada, Guadeloupe, Porto Rico, Cuba.
vexator Harold. St. Thomas.
vincentiæ Arrow. St. Vincent.

Saprosites *Redtenbacher.*

grenadensis Arrow. Grenada.

Psammodius *Heer.*

parvulus Chevrolat. Grenada, St. Vincent, Cuba.

Ægidium *Westwood.*

parvulum Westwood. Guadeloupe.
vincentiæ Arrow. St. Vincent.

Cœlodes *Lacordaire.*

nigripennis Arrow. St. Vincent.

Hapalonychus *Lacordaire.*

waterhousei Westwood. Cuba
rufulus Castelnau. Haiti.

Athyreus *MacLeay.*

angulatus Klug. Cuba.
tridentatus MacLeay var: *castaneus* Guérin. Cuba.
biceps Felsche. Haiti.
tweedianus Westwood. Haiti.

Geotrupes *Latreille.*

ovalipennis Jekel. Haiti.
splendidus Fabricius (= *gilnicki* Jakel). Haiti?
meridionalis Beauvois. Haiti?
thoracinus Beauvois. Haiti?

Trox *Fabricius.*

chevrolatii Harold. Cuba.
insularis Chevrolat. Cuba.
gibbus Olivier. Haiti.
ovatus Beauvois. Haiti.
pustulatus Leconte. Haiti.
suberosus Fabricius (*crenatus* Oliv.). St. Vincent, Guadaloupe, Haiti, Jamaica, Cuba.

Clœotus *Germar.*

rufopiceus Arrow. Grenada, St. Vincent.
crassicollis Arrow. St. Vincent.

Acanthocerus *MacLeay.*

semistriatus Germar. Cuba.
pyritosus Erichson. St. Thomas, Guadeloupe.
relucens Bates. St. Vincent.
gundlachi Harold. Cuba.
chalceus Germar. Cuba.

Diplotaxis *Kirby.*

ebenina Blanchard. Martinique.

Lachnosterna *Hope.*

æruginosa Burmeister. Cuba.
analis Burmeitser. Cuba.
angusta Blanchard. Cuba.
bifoveolata Jacquelin Duval.
crenaticollis Blanchard. Cuba.
cylindrica Burmeister. Antilles.
denticulata Blanchard. Guadeloupe, Martinique.
dissimilis Chevrolat. Cuba.
fervida Fabricius. Haiti, Jamaica.
guadalupensis Blanchard. Guadeloupe.
hogardi Blanchard. Haiti.
latens Arrow. St. Vincent.
neglecta Blanchard. Haiti.
parallela Blanchard. Cuba.
patens Arrow. St. Vincent.
patruelis Chevrolat. Guadeloupe, Haiti, Cuba.
plœi Blanchard. Martinique.
puberula Jacquelin Duval. Cuba.
signaticollis Burmeister. Cuba.
speculifera Chevrolat. Cuba?
subsericans Jacquelin Duval. Cuba.
suturalis Chevrolat. Cuba.
trinitatis Arrow. Trinidad.
tuberculifrons Chevrolat. Cuba.

Phytalus *Erichson.*

apicalis Blanchard. St. Thomas.
smithi Arrow. Barbados.

Anoplosiagum *Blanchard.*

pallidulum Blanchard. Cuba.
variabile Chevrolat. Cuba.

Clavipalpus *Castelnau.*

rutilus Chevrolat. Cuba.

Plectris *Serville.*

fungicola Arrow. St. Vincent.
lignicola Arrow. St. Vincent.

Ceraspis *Serville.*

insularis Arrow. St. Vincent.

Anomala *Koeppe.*

calceata Chevrolat. Cuba.
forsstroemi Billberg. Antilles.
insularis Castelnau. Guadeloupe, Haiti.
luciæ Blanchard. St. Lucia.
valida Burmeister. Guadeloupe.
inconstans Burmeister. St. Vincent, St. Lucia.

Strigoderma *Burmeister.*

marginata Olivier. Guadeloupe.

Cnemida *Kirby.*

retusa Fabricius. Guadeloupe.

Macraspis *MacLeay.*

tristis Castelnau. Guadeloupe.

Antichira *Eschscholtz.*

lucida Olivier. Guadeloupe.
meridionalis Reiche. Jamaica.
tetradactyla Linné. Jamaica.

Cyclocephala *Latreille.*

immaculata Olivier. Guadeloupe, Bahamas.
dimidiata Burmeister. Grenada.
vincentiæ Arrow. St. Vincent.
signata Drury. Grenada, Jamaica, Cuba.
cerea Burmeister. Jamaica.
frontalis Chevrolat. Cuba.
grandis Burmeister. Guadeloupe.
notata Illiger. Haiti.
rubiginosa Burmeister. Martinique.
sanguinicollis var: *verticalis* Burmeister. Cuba.
rustica Linné. Guadeloupe.
tetrica Voet. Jamaica.
tridentata Fabricius. Guadeloupe, Martinique.

Chlorota *Burmeister.*

tristis Arrow. St. Vincent.

Pelidnota *MacLeay.*

velutipes Arrow. Grenada, Balthazar.
sancti domini Ohaus. Haiti.

Rutela *Latreille.*

dorcyi Olivier. Haiti.
formosa Burmeister. Cuba.
glabrata Fabricius. Jamaica.
striata Olivier. Guadeloupe.
lineola Linné. Guadeloupe.

Democrates *Burmeister.*

crœsus Newman. Jamaica, Haiti.

Leucothyreus *MacLeay.*

guadalupensis Burmeister. Guadeloupe.
vicentiæ Arrow. St. Vincent.

Dyscinetus *Harold.*

barbatus Fabricius. Antilles.
obsoletus Leconte. Bahamas.
trachypygus Burmeister. Cuba.
picipes Burmeister. Guadeloupe, Haiti, Cuba.

Ligyrus *Burmeister.*

cordatus Fabricius. Haiti.
juvencus Fabricius. Jamaica.
ebenus DeGeer. St. Martin, Guadeloupe.
tumulosus Burmeister. Barbados, Trinidad, St. Vincent, Nevis, Guadeloupe, St. Bartholomew, Jamaica, Porto Rico, Cuba.

Xyloryctes *Hope.*

jamaicensis Fabricius. Antilles.

Strategus *Hope.*

antæus Fabricius. Haiti?
julianus Burmeister. Grenada?
anachoreta Burmeister. Cuba.
quadrifoveatus Beauvois. Haiti, Porto Rico.
?tricornis Verrill. Dominica.
syphax Fabricius. Guadeloupe?, Haiti, Cuba.
vulcanus Fabricius. Guadeloupe.
titanus Fabricius. Porto Rico, Jamaica, Cuba.
talpa Fabricius. St. Bartholomew, St. Croix.
sarpedon Burmeister. Cuba.
?fascinus Burmeister. Grenada.

Golofa *Hope.*

guildingi Hope. St. Vincent.

Dynastes *Kirby.*

argentata Verrill. Dominica.
hercules Linné. Guadeloupe.
lagaii Verrill. Dominica.
vulcan Verrill. Dominica.

Phileurus *Latreille.*

didymus Linné. Trinidad, Grenada, St. Vincent, Dominica.
valgus Linné. Grenada, St. Vincent, Guadeloupe, Jamaica, Cuba.
subsp. *septentrionis* Kolbe. Antilles.

Epiphileurus *Kolbe.*

planicollis Chevrolat. Cuba.
cribratus Chevrolat. Cuba.
dispar Kolbe. Haiti.

Homophileurus *Kolbe.*

quadrituberculatus Beauv. Grenada, Haiti, Porto Rico, Cuba.
cubanus Prell. Eastern Cuba.

Allorhina *Burmeister.*

cornuta Gory & Percheron. Cuba.

Gymnetis *MacLeay.*

guadalupensis Gory & Percheron. Guadeloupe.
incerta Gory & Percheron. Haiti.
lanius Linné. Jamaica.
marmorea Olivier. Antilles.
spencei Gory & Percheron. Jamaica.
undata Olivier var: *similis* Burmeister. Haiti.
sternalis Chevrolat. Cuba.

Family L. CERAMBYCIDÆ.

Parandra *Latreille.*

cribrata Thomson. Porto Rico, Haiti, Cuba.
cubæcola Chevrolat. Porto Rico, Cuba.
glabra DeGeer (*lineolata* Gory). St. Vincent, Guadeloupe.
lævis Latreille. Haiti.

Strongylaspis *Thomson.*

corticaria Erichson (*scobinata* Chev.) Jamaica, Cuba.

Mallodon *Serville.*

spinibarbis Linné. St. Vincent.

Nothopleurus *Lacordaire.*

maxillosus Drury. Barbados, Guadeloupe, St. Christopher, St. Bartholomew, St. Martin.
bituberculatus Beauvois (*carptor* Chev.). St. Thomas, Porto Rico, Haiti, Jamaica, Cuba.

Stenodontes *Serville.*

chevrolati Gahan. Cuba, Bahamas.
damicornis Linné. Jamaica.
cubensis Casey. Cuba.
exsertus Olivier. Florida, Haiti, Porto Rico.

Stictosomus *Serville.*

ruber Thunberg. Guadeloupe.

Dendroblaptus *Chevrolat.*

barbiflavus Chevrolat. Cuba.

Callomegas *Lameere.*

sericeus Olivier. Porto Rico, Haiti, Cuba.
proletarius Lameere. Porto Rico.

Orthomegas *Serville.*

cinnamoneus Linné. Trinidad, Grenada.

Cubæcola *Lameere.*

hoploderoides Lameere. Cuba.

Prosternodes *Thomson.*

cinnamipennis Chevrolat. Cuba.
dominicensis Gahan. Haiti.
oberthüri Gahan. Haiti.
scutellatus Gahan. Haiti, Cuba.

Derancistrus *Serville.*

anthracinus Gahan. Haiti.
cœruleus Lameere. Cuba?
elegans Beauvois. Haiti.

Solenoptera *Serville.*

bilineata Fabricius. Guadeloupe, St. Lucia, St. Croix, St. Thomas, Haiti.
canaliculata Fabricius. Trinidad, Mustique, Young, Becquia, St. Vincent.
var: *asterius* Gahan. Guadeloupe, Martinique.
luciæ Lameere. St. Lucia.
parandroides Lameere. Cuba.
metallescens Thomson. Dominica, Cuba?
quadrilineata Olivier. Guadeloupe, Martinique.
sulcicollis Thomson. Guadeloupe.
thomae Linné. St. Thomas, Guadeloupe, Porto Rico.

Elateropsis *Chevrolat.*

ebeninus Chevrolat. Jamaica.
femoratus Sallé. Haiti.
fimbriatus Chevrolat. Cuba.
fulvipes Chevrolat. Cuba.
lineatus Linné (*subpunctatus* Chev., *fuliginosus* Fab.). Jamaica, Cuba.
punctatus Gahan. Cuba.
reticulatus Gahan. Cuba.
quinquenotatus Chevrolat. Cuba, Jamaica.
rugosus Gahan. Eleuthera, Bahamas.
scabrosus Gahan (*fuliginosus* Chev.). Cuba.
sericeiventris Chevrolat. Cuba.
venustus Chevrolat. Cuba.

Orthosoma *Say.*

brunneum Forster. Guadeloupe, Haiti.

Monodesmus *Serville.*

callidioides Serville. Cuba.
nothus Chevrolat. Jamaica?

Hephialtes *Thomson.*

tricostatus Thomson. Guadeloupe.

Smodicum *Haldeman.*

brunneum Thomson. Haiti.
impressicolle Lacordaire. Haiti, Cuba.
miserum Thomson. Haiti.

Enosmæus *Thomson.*

cubanus Thomson. Cuba.

Methia *Newman.*

punctata Leconte (*pusilla* Newn). Cuba.
necyaalea Fabricius. Grenada, Guadeloupe, St. Thomas, Porto Rico, Haiti, Jamaica, Cuba.

Achryson *Serville.*

ornatipenne Perroud. Guadeloupe.
surinam Linné var: *circumflexum* Fabricius. Grenada, St. Vincent, Antigua, Dominica, Guadeloupe, Haiti, Jamaica, Cuba.

Araespor *Thomson.*

longicollis Thomson. Cuba?

Stromatium *Serville.*

fulvum Villers (*unicolor* Laich.). Cuba.

Chion *Newman.*

cinctus Drury. Bahamas.

Chlorida *Serville.*

festiva Linné. Trinidad, Barbados, Grenada, St. Vincent, Antigua, Dominica, Guadeloupe, Porto Rico, Jamaica, Cuba.

Pantomallus *Lacordaire.*

inermis Fleutiaux & Sallé. Guadeloupe.

Eburia *Serville.*

bimaculatus Voet. Antigua.
cinnamonea Fleutiaux. Guadeloupe.
consobrina Jacquelin Duval. Jamaica.
decemmaculata Fabricius. Guadeloupe, Antigua, St. Bartholomew.
dejeani Gahan. Guadeloupe, Martinique.
didymus Olivier (*pulvurea* Chev.). Cuba.
octomaculata Chevrolat. Guadeloupe, Dominica, Cuba.
postica White. Jamaica.
quadrimaculata Linné. St. Thomas, Guadeloupe, Porto Rico.
sericea Sallé. Haiti.
stigma Olivier (*duvalii* Chev). Haiti, Cuba, Bahamas.
tetrastalacta White. Jamaica.
quadrigeminata Say. Cuba?
insulana Gahan. St. Vincent.

Eburodacrys *Thomson.*

havanensis Chevrolat. Cuba.

Elaphidion *Serville.*

albosignatum Chevrolat. Cuba.
conspersum Newman. Haiti, Jamaica?
excelsum Gahan. Guadeloupe.
fullonium Newman. Haiti.
glabratum Fabricius. St. Thomas, St. Bartholomew, Guadeloupe.
guttiventre Chevrolat. Cuba.
insulare Newman. Nevis.
irroratum Linné. St. Bartholomew, Guadeloupe, Haiti, Jamaica, Cuba.
lanatum Chevrolat. Cuba.
lucidum Olivier. Haiti.
mutatum Gahan. Cuba.
nanum Fabricius (*cinereum* Chev). St. Thomas, Haiti, Cuba.
newmani Haldeman. Antilles?
pulverulentum Olivier. Cuba.
quadrituberculatum Chevrolat. Cuba.
signaticolle Chevrolat. Cuba.
spinicorne Drury. Haiti, Jamaica, Porto Rico.
subfasciatum Gahan. Guadeloupe.
thomæ Gahan. St. Thomas.
tomentosum Chevrolat. Haiti, Cuba.
transversum White. Jamaica.
villosum Fabricius (*parallelum* Newm.) (*pruinosum* Guér). Cuba.
bidens Fabricius. Antilles?
sp. ? Bahamas.

Protosphærion *Gounelle.*

insulare White. Jamaica.

Stizocera *Serville.*

poeyi Guérin. Cuba.

insulanum Gahan. Jamaica.

Haruspex *Thomson.*

inscriptus Gahan. Grenada.

Hormathus *Gahan.*

cinctellus Gahan. Haiti.

Heterachthes *Newman.*

quadrimaculatum Fabricius. Grenada, Mustique, St. Vincent, Antigua, Dominica, Guadeloupe.

Neocorus *Thomson.*

romanowskii Fleutiaux. Guadeloupe.

Cylindera *Newman.*

flava Fabricius (*pilicornis* Fab.). Grenada, St. Vincent, St. Cruz, Guadeloupe, Jamaica, Cuba.

puberula Fleutiaux & Sallé. Grenada, St. Vincent. Guadeloupe.

Merostenus *White.*

productus White. Jamaica.

attenuatus Chevrolat. Cuba.

Plectromerus *Leconte.*

distinctus Cameron. Haiti.

serratus Cameron. Haiti.

Pentomacrus *White.*

fasciatus Gahan. Grenada, St. Vincent.

femoratus Fabricius. Jamaica.

Ophistomis *Thomson.*

thoracica Fleutiaux. Guadeloupe.

Molorchus *Fabricius.*

ruficollis Gahan (*sanguinicollis* Gundlach). Cuba.

Acyphoderes *Serville.*

abdominalis Olivier. Porto Rico.

Bromiades *Thomson.*

brachyptera Chevrolat. Cuba.

Tethlimmena *Bates.*

basalis Gahan. St. Vincent.

Philematium *Thomson.*

femorale Olivier (*leucodactyla* Chev.). Cuba.
festivum Fabricius. Guadeloupe.

Callichroma *Latreille.*

elegans Olivier. Guadeloupe? Grenada.
var: *gahani* Aurivillius. Dominica.
rufescens Gahan. St. Lucia, Guadeloupe.
spectabile Voet. Antilles.
virens Drury (*columbina* Dej.). Haiti, Jamaica, Cuba.
vittatum Fabricius. Haiti.
?plicatum Leconte. Bahamas.

? Callidium *Fabricius.*

biguttatum Sallé. Haiti.

Cyllene *Newman.*

difficilis Chevrolat. Cuba.
crinicornis Chevrolat. Jamaica?

Euryscelis *Chevrolat.*

dejeani Chevrolat. Haiti.
suturalis Olivier. Haiti.

Neoclytus *Thomson.*

araneiformis Olivier. Guadeloupe, Haiti, Porto Rico.
cordifer Klug (*devastator* Lap & Gory). Cuba.
chevrolati Laporte & Gory. Cuba.
longipes Drury. Jamaica.
podagricus White. Haiti.

Isotomus *Mulsant.*

insularis Laporte & Gory. Haiti.

Tilloclytus *Bates.*

nivicinctus Chevrolat. Cuba.

Mallosoma *Serville.*

bicolor Sallé. Haiti.

Trichrous *Chevrolat.*

dimidiatipennis Chevrolat. Haiti, Cuba.
divisus Chevrolat. Cuba.
pilipennis Chevrolat. Cuba.
jamaicensis Chevrolat. Jamaica.
basalis White. Jamaica.
jaegeri Chevrolat. Haiti.
irroratus Olivier. Haiti.
lineolatus White. Jamaica.
terminalis White. Jamaica.
major Gahan. Jamaica.

Heterops *Blanchard.*

loreyi Duponchel. Cuba.
bipartita Lacordaire. Cuba.
lanieri Chevrolat. Cuba.
dimidiata Chevrolat. Cuba.

Eburiola *Thomson.*

geminata Fabricius. Jamaica.

Poeciloderma *Thomson.*

lepturoides Jacquelin Duval. Haiti, Cuba.

Olbius *Thomson.*

sexfasciatus Olivier. Jamaica.

Plectrocerum *Lacordaire.*

spinicorne Olivier. Haiti.

cribratum Sallé. Haiti.

Dendrobias *Serville.*

maxillosus Serville. Martinique.

Trachyderes *Dalm.*

succinctus Linné. Trinidad, Grenada, Guadeloupe?

Oxymerus *Serville.*

luteus Voet. Grenada, Mustique, St. Vincent.

Subfamily Lamiidæ.

Nanilla *Fleutiaux & Sallé.*

delauneyi Fleutiaux & Sallé. Guadeloupe.

Ptychodes *Serville.*

trilineatus Linné. Trinidad, Jamaica, Cuba.

Tæniotes *Serville.*

insularis Thomson. Dominica, Guadeloupe, Cuba.

leucogrammus Thomson. Martinique.

pulverulentus Olivier. Guadeloupe, Martinique.

scalaris Fabricius. Grenada.

Phryneta *Castelnau.*

verrucosa Drury. Trinidad, Barbados, Grenada.

Adetus *Leconte.*

lherminieri Fleutiaux & Sallé. Grenada, St. Vincent, Guadeloupe.

Prœcha *Thomson.*

spinipennis Chevrolat. Cuba.

Desmiphora *Serville.*

hirticollis Olivier. Grenada, St. Vincent, Cuba.

pallida Bates. Jamaica.

Phidola *Thomson.*

lanuginosa Chevrolat. Cuba.

maculicornis Chevrolat. Cuba.

Eupogonius *Leconte.*

pilosulus Chevrolat. Cuba.

rubiginosus Chevrolat. Cuba.

Lypsimena *Leconte.*

fuscata Leconte. Cuba.

Zaplous *Leconte.*

annulatus Chevrolat. Cuba.

Ischiocentra *Thomson.*

signifera Buquet. Guadeloupe.

Hypsioma *Serville.*

picticornis Bates. Grenada.

grisea Fleutiaux. Guadeloupe.

Trestonia *Buquet.*

fulgurata Buquet. Guadeloupe.

Cacostola *Fairmaire.*

ornata Fleutiaux. Grenada, Mustique, Becquia, Guadeloupe.

Oncideres *Serville.*

amputator Fabricius. St. Vincent, Guadeloupe.

Epectasis *Bates.*

similis Gahan. Grenada.

Tethystola *Thomson.*

mutica Gahan. Grenada, St. Vincent.

Spalacopsis *Newman.*

filum Klug. Porto Rico, Haiti, Cuba.

grandis Chevrolat. Cuba.

Dorcasta *Pascoe.*

obtusa Bates. St. Vincent, Cuba.

Ecyrus *Leconte.*

hirtipes Gahan. Grenada.

Oreodera *Serville.*

glauca Linné. Dominica, Guadeloupe, Haiti, Jamaica.

lateralis Olivier. Porto Rico, Cuba.

Steirastoma *Serville.*

depressum Linné. Trinidad, Grenada.
histrionicum White. Jamaica.
pustulatum Drury. Jamaica.
acutipenne Sallé. Haiti.
poeyi Chevrolat. Cuba.

Acanthoderes *Serville.*

circumflexa Jacquelin Duval. Cuba.
decipiens Haldeman. Bahamas.

Lagochirus *Erichson.*

araneiformis Linné. Grenada, St. Vincent, Guadeloupe, Antigua, St. Thomas, St. Bartholomew, Haiti, Jamaica, Cuba.
obsoletus Thomson. Cuba.
tuberculatus Fabricius. Jamaica?

Alcidion *Thomson.*

socium Gahan. Grenada, St., Vincent.

Leptostylus *Leconte.*

argentatus Jacquelin Duval. Cuba.
incrassatus Klug (*transversatus* Jacq. Duv.). Cuba.
sagittatus Jacquelin Duval. Porto Rico. Cuba.
dealbatus Jacquelin Duval. Cuba.
smithi Gahan. Grenada, Mustique, Becquia.
jamaicensis Gahan. Jamaica.
posticalis Gahan. Grenada, St. Vincent.
inermis Fabricius. Guadeloupe.
parvulus Gahan. Grenada, Mustique.
biustus Leconte. Haiti, Cuba.
scurrus Chevrolat. Cuba.
præmorsus Fabricius. Guadeloupe.
?præmorsus Dejean Cat. St. Bartholomew.
?bidentatus Dejean Cat. Nevis, Guadeloupe.
?similis Dejean Cat. Grenada, St. Vincent, Dominica.
?assimilis Dejean. Dominica, Guadeloupe.
?calcarius Chevrolat. Cuba.

Lepturges *Bates.*

guadeloupensis Fleutiaux. Grenada, Mustique, Guadeloupe.
sp. ?. Gahan. St. Vincent.

Probatius *Thomson.*

umbraticus Jacquelin Duval. Porto Rico, Cuba.

Carneades *Bates.*

bicincta Gahan. Guadeloupe.

Decarthria *Hope.*

albofasciata Gahan. Grenada.
stephensi Hope. St. Vincent.

Myrmolamia *Bates.*

fauveli Cameron. Haiti.

Amphionycha *Leseleuc.*

nigriventris Chevrolat. Guadeloupe.

Calocosmos *Chevrolat.*

nuptus Chevrolat. Cuba.
venustus Chevrolat. Cuba.
speciosus Chevrolat. Cuba.
dimidiatus Chevrolat. Cuba.
nigripennis Chevrolat. Cuba.
janus Bates. Cuba.
semimarginatus Bates. Cuba.
holosericeus Chevrolat. Haiti.
melanurus Gahan. Haiti.
marginipennis Chevrolat. Jamaica.

Drycothea *Thomson.*

guadeloupensis Fleutiaux & Sallé. Guadeloupe.

Family LI. CHRYSOMELIDÆ.

Donacia *Fabricius.*

antillarum Suffrian. Cuba.

Lema *Fabricius.*

bifida Olivier. Guadeloupe, Cuba.
cœruleipennis Lacordaire. Cuba.
confusa Chevrolat. Cuba.
cubana de Borre. Cuba.
dorsalis Olivier. St. Vincent, Grenada, Porto Rico, Cuba.
guadelupensis Jacoby. Guadeloupe.
gundlachiana Suffrian. Cuba.
insularis Jacoby. Tobaga, St. Vincent.
lunigera Suffrian. Cuba.
mannerheimi Lacordaire. Haiti, Cuba.
marginata Olivier. Grenada.
nigripes Weise. Porto Rico.
nigroarcuata Clark. Guadeloupe.
obscura Fabricius. St. Vincent, Grenada.
ochracea Fleutiaux. Guadeloupe.
perizonata Lacordaire. Cuba.
placida Lacordaire. Cuba.
poeyi Lacordaire. Cuba.
polita Lacordaire. Porto Rico.
postica Guérin. Cuba.
punctatofasciata Lacordaire. Cuba.
quadricolor Lacordaire. Cuba.
retusa Fabricius. Guadeloupe.
sharpi Jacoby. Grenada.
trilineata Olivier. Cuba.
vittatipennis Baly. St. Vincent.

Anomœa *Lacordaire.*

insularis Jacoby. Trinidad.

Coscinoptera *Lacordaire.*

intermedia Jacoby. St. Vincent.

Mastacanthus *Suffrian.*

insularis Suffrian. Cuba.
arcustriatus Chevrolat. Cuba.

Pachybrachys *Redtenbacher.*

brunneolus Suffrian. Cuba.
carmelitus Suffrian. Haiti.
conglomeratus Suffrian. Cuba.
decipiens Suffrian. Cuba.
devotus Suffrian. Cuba.
flavocallens Suffrian. Cuba.
gundlachi Suffrian. Cuba.
mendicus Weise. Porto Rico.
militans Suffrian. Cuba.
parallelepipedus Suffrian. Cuba.
prætextatus Suffrian. Porto Rico.
pumicatus Suffrian. Cuba.
scabripennis Jacoby. St. Vincent, Grenada, Union, Becquia, Grenadines.
sparsutus Suffrian. Haiti.
tostus Suffrian. Cuba.

Cryptocephalus *Geoffroy.*

amethystinus Suffrian. Jamaica.
azureipennis Suffrian. Cuba.
balteatus Suffrian. Haiti.
bicinctus Suffrian. Cuba.
censorius Suffrian. Cuba.
chloroticus Olivier. Haiti, Cuba.
commutatus Suffrian. Cuba.
complanatus Suffrian. Cuba.
crabroniformis Suffrian. Haiti.
crenulatus Suffrian. Cuba.
cubanensis Jacoby. Cuba.
curtus Suffrian. Cuba.
cylindricus Suffrian. Cuba?
dissectus Suffrian. Haiti.
distensus Chevrolat. Cuba.
dives Suffrian. Cuba.
erubescens Suffrian. Jamaica.
exaratus Suffrian. Haiti.
fuliginosus Suffrian. Haiti.
grammicus Suffrian. Guadeloupe.
grossulus Suffrian. Cuba.
guadeloupensis Fleutiaux. Guadeloupe.
gundlachi Jacoby. Cuba.
haitiensis Jacoby. Haiti.
hilaris Suffrian. Haiti.
hypocritus Suffrian. Cuba.
krugi Weise. Porto Rico.
marginicollis Suffrian. Cuba.
multiguttatus Suffrian. Haiti.
nigrocinctus Suffrian. Porto Rico.
octodecimguttatus Suffrian. Haiti.
ovatus Fleutiaux. Guadeloupe.
pavidus Suffrian. Cuba.
perspicax Weise. Porto Rico.
pictus Suffrian. Cuba.
poeyi Suffrian. Cuba.
polygrammus Suffrian. Porto Rico.
quatuordecimsignatus Suffrian. Haiti.
rubetra Suffrian. Cuba.
rubricus Suffrian. Haiti.
rubrofasciatus Suffrian. Cuba.
rufitarsis Suffrian. Cuba.
rusticus Suffrian. Cuba.
saucius Suffrian. Cuba.
var: *ephippium* Suffrian. Cuba.
sericatus Suffrian. Cuba.
signatellus Suffrian. Cuba.
spectator Weise. Guadeloupe.
splendidus Suffrian. Jamaica.
stercorator Suffrian. Antilles.
stolidus Weise. Porto Rico.
strigicollis Suffrian. Haiti.
subelatus Tappes. Cuba.
thalassinus Suffrian. Cuba.
tibiellus Suffrian. Cuba.
tortuosus Suffrian. Porto Rico, Cuba.
tricostatus Jacoby. St. Vincent, Grenada.
tristiculus Weise. Porto Rico.
vinctus Suffrian. Cuba.
vinulus Suffrian. Cuba.
viridipennis Suffrian. Cuba.
vitraci Fleutiaux. Guadeloupe.
xerampelinus Suffrian. Cuba.

Diachus *Leconte.*

nothus Weise. Porto Rico.
pusio Suffrian. Cuba.

Chlamys *Knoch.*

flavicollis Lacordaire. Cuba.
haitiensis Bowditch. Haiti.
melanospila Suffrian. Cuba.
nigritella Suffrian. Cuba.
straminea Suffrian. Cuba.

Exema *Lacordaire.*

carinaticollis Lacordaire. Antilles.

Lamprosoma *Kirby.*

auricolle Suffrian. Cuba.
longifrons Suffrian. Porto Rico.

Nodonota *Lefevre.*

grenadensis Jacoby. Grenada, St. Vincent.

Rhabdoptera *Lefevre.*

picipes Olivier. Grenada, St. Vincent.

Noda *Chapuis.*

fusca Drapiez. Cuba.
luteicornis Fabricius. Antilles.

Colaspis *Fabricius.*

alcyonea Suffrian. Porto Rico, Cuba.
nigricornis Suffrian. Cuba?
obscura Fabricius. Antilles.
smaragdula Olivier. Haiti, Jamaica, Cuba.
unicolor Olivier. Antilles.
ebasi Lefevre. Grenada.
fastidiosa Lefevre. Grenada, St. Vincent, Grenadines, Union, Mustique, Becquia.
insidiosa Lefevre. Antilles.
femoralis Lefevre. St. Vincent.
chevrolati Lefevre. Haiti.

Chalcophana *Chevrolat.*

abdominalis Suffrian. Cuba.
elongata Suffrian. Cuba.
fervida Suffrian. Cuba.
striata Suffrian. Cuba.
varicornis Suffrian. Cuba.
viridula Suffrian. Cuba.

Heteraspis *Blanchard.*

nana Suffrian. Cuba.

Metachroma *Leconte.*

adusta Suffrian. Cuba.
antennalis Weise. Porto Rico.
læviuscula Suffrian. Cuba.
liturata Suffrian. Cuba.
puncticollis Suffrian. Cuba.
sordida Suffrian. Cuba.
suturalis Suffrian. Cuba.

Myochrous *Erichson.*

denticollis Say. Grenada.
brevicornis Olivier. Haiti.
dubius Fabicius. Cuba.

Typophorus *Erichson.*

viridicyaneus Crotch. Grenada, St. Vincent, Grenadines, Becquia.

Phædon *Latreille.*

splendicans Stål. Cuba.
nigripes Jacoby. Grenada.

Melasoma *Stephens.*

cruentipennis Jacquelin Duval. Cuba.

Leucocera *Stål.*

æneomicans Stål. Haiti.
amarella Suffrian. Cuba.
lævicollis Weise. Porto Rico.
quadriguttata Chevrolat. Haiti.
ferruginea Chevrolat. Haiti.
apicicornis Chevrolat. Cuba.
cubana Stål. Cuba.
hexaspila Suffrian. Cuba.
insulana Jacquelin Duval. Cuba.
insularis Stål. Cuba.
nydia Stål. Cuba.
octopustulata Stål. Haiti.
optica Suffrian. Cuba.
poeyi Chevrolat. Cuba.
quinquepunctata Linné. Haiti.
rubropustulata Suffrian. Cuba.
semilutea Stål. Cuba.
sexguttata Chevrolat. Cuba.
testaceipes Stål. Cuba.

Cerotoma *Chevrolat.*

liturata Suffrian. Cuba.
ruficornis Olivier. Grenada, Grenadines, St. Vincent, Becquia, Barbados, Guadeloupe, Porto Rico, Jamaica, Cuba.

Monocesta *Clark.*

opacipennis Jacquelin Duval. Cuba.

Asbecesta *Harold.*

violacea Allard. Cuba.

Galerucella *Crotch.*

venustula Suffrian. Cuba.
obliterata Olivier. Porto Rico.
varicornis Weise. Porto Rico.

Schematiza *Blanchard.*

livida Olivier. Grenada, Guadeloupe.

Luperus *Geoffroy.*

placidus Suffrian. Cuba.
malachioides Suffrian. Cuba.

Malacosoma *Chevrolat.*

insularis Harold. Cuba.
detritum Fabricius. Guadeloupe.

Diabrotica *Chevrolat.*

bivittata Fabricius. Grenada, St. Vincent.
graminea Baly. Porto Rico.
æruginea Fabricius. Porto Rico.
annulata Suffrian. Cuba.
cyanospila Suffrian. Cuba.
fucata Fabricius. Antilles.
innuba Fabricius. Guadeloupe, Porto Rico.
loricata Suffrian. Cuba.
var: *sinuata* Olivier. Antilles.
melanocephala Fabricius. Grenada, St. Vincent.
ochreata Fabricius. Guadeloupe.
pallipes Olivier. Porto Rico, Cuba.
pulchella Jacquelin Duval. Cuba.
quadriguttata Olivier. Haiti, Porto Rico, Cuba.
relicta Suffrian. Cuba.
semicyanea Suffrian. Cuba.
impressa Suffrian. Porto Rico, Cuba.

Oedionychis *Latreille.*

cubana Harold. Cuba.
sharpi Jacoby. St. Vincent.
smithi Jacoby. Grenada.
tortuosa Suffrian. Cuba.
picta Suffrian. Cuba.
jamaicensis Jacoby. Jamaica.
fasciata Fabricius. Haiti, Cuba.
decempunctata Suffrian. Cuba.
cyanipennis Fabricius. Porto Rico, Cuba.
decemguttata Fabricius. Porto Rico.
complanata Suffrian. Cuba.
bicolor Linné. Haiti, Porto Rico, Cuba.

Hypolampsis *Clark.*

annulicornis Jacoby. Grenada, St. Vincent.
nigrina Clark. St. Pauls.

Physimerus *Clark.*

smithi Jacoby. Grenada, St. Vincent.

Omototus *Clark.*

fulvopubescens Clark. Cuba.
ferrugineus Suffrian. Porto Rico, Cuba.

Homophœta *Erichson.*

æquinoctialis Fabricius. Grenada, St. Vincent, Guadeloupe.

Hermæophaga *Foudras.*

smithi Jacoby. St. Vincent.
cylindrica Weise. Porto Rico.

Haltica *Geoffroy.*

satellitia Jacoby. Grenada, St. Vincent.
œnea Olivier. Guadeloupe.
amethystina Olivier. Haiti.
dichroa Suffrian. Cuba.
gravdula Suffrian. Porto Rico, Cuba.
jamaicensis Fabricius. Haiti, Porto Rico, Jamaica, Cuba.
occidentalis Suffrian. Guadeloupe, Porto Rico, Cuba.
pauxilla Suffrian. Cuba.
purpurascens Suffrian. Cuba.
quatuordecimpunctata Suffrian. Cuba.
stomachosa Suffrian. Cuba.

Crepidodera *Chevrolat.*

asphaltina Suffrian. Porto Rico, Cuba.

Pseudepitrix *Jacoby.*

suffriani Jacoby. St. Vincent.

Epitrix *Foudras.*

fuscata Jacquelin Duval. Grenada, Cuba.
subfusca Jacoby. Grenada.
parvula Fabricius. Grenada, St. Vincent, Porto Rico, Cuba.

Systena *Clark.*

s-littera Linné. Grenada, St. Vincent.
bicolor Jacoby. Grenada, St. Vincent.
varia Weise. Porto Rico.
basalis Jacquelin Duval. Porto Rico, Cuba.
cœruleipennis Suffrian. Cuba.

Podagrica *Foudras.*

cyanipennis Weise. Guadeloupe.

Disonycha *Chevrolat.*

adspersula Suffrian. Cuba.
chlorotica Olivier. Porto Rico, Cuba.
pallipes Weise. Porto Rico.
chlathrata Suffrian. Cuba.
collata Fabricius. Cuba.
costipennis Jacquelin Duval. Cuba.
fimbriolata Suffrian. Cuba.
glabrata Fabricius. Grenada, Jamaica.
interstitialis Suffrian. Porto Rico, Cuba.
marginipennis Suffrian. Cuba.
minima Suffrian. Cuba.
pyritosa Suffrian. Cuba.
robusta Suffrian. Cuba.
lœvigata Jacoby. Grenada.

Lactica *Erichson.*

corallina Chevrolat. Guadeloupe.
ferruginea Olivier. Haiti.
scutellaris Olivier. Porto Rico, Cuba.
tibialis Olivier. Cuba.
apicipes Jacoby. Grenada, St. Vincent.
laevicollis Jacoby. St. Vincent.

Diphaulaca *Clark.*

advena Fabricius. Antilles.
sanctœ-crucis Fabricius. Antilles.

Glyptina *Leconte.*

nigrita Jacoby. Grenada.

Sophræna *Baly.*

coccinelloides Suffrian. Cuba.

Longitarsus *Latreille.*

seminulum Suffrian. Cuba.
subœneus Suffrian. Cuba.
varicornis Suffrian. Porto Rico, Cuba.
horni Jacoby. Grenada, St. Vincent.

Aphthona *Chevrolat.*

compressa Suffrian. Porto Rico, Cuba.
grenadensis Jacoby. Grenada, St. Vincent.
maculipennis Jacoby. Grenada, St. Vincent.

Phyllotreta *Foudras.*

fallax Suffrian. Porto Rico, Cuba.

Oxygona *Chevrolat.*

pallens Fabricius. Guadeloupe.

Palæothona *Jacoby.*

semifulva Jacoby. Guadeloupe.

Chaetocnema *Stephens.*

apricaria Suffrian. Porto Rico, Cuba.
tuberculata Suffrian. Cuba.
nana Jacoby. Grenada.
?minutà Melsheimer. Grenada, St. Vincent.

Homophyla *Harold.*

krugi Weise. Porto Rico.
unicolor Jacoby. Grenada, St. Vincent.

Blepharida *Rogers.*

irrorata Chevrolat. Porto Rico.

Asphæra *Chevrolat.*

crucipennis Suffrian. Cuba.
lunata Fabricius. Antilles.
abbreviata Fabricius. Guadeloupe.
nobilitata Fabricius. Trinidad.

Euplectroscelis *Crotch.*

?variabilis Jacoby var: *rubra* Jacoby. Guadeloupe.

Aedmon *Clark.*

sericellum Clark. Porto Rico.

Megistops *Boheman.*

adulta Suffrian. Cuba.
rubropustulata Suffrian. Cuba.
fictor Weise. Porto Rico.
granulatus Jacoby. Grenada.

Demothispa *Baly.*

sallei Baly. Haiti.

Melanispa *Baly.*

truncata Baly. Guadeloupe.

Agathispa *Weise.*

dimidiata Olivier. Haiti.

Anisostena *Weise.*

cyanoptera Suffrian. Cuba.

Chalepus *Thunberg.*

plebejus Chapuis. Grenada, St. Vincent.
sanguinicollis Linné (*axillaris* Duval). Grenada, St. Vincent. Haiti, Porto Rico, Cuba.
rufiventris Suffrian. Cuba.
dorsalis Thunberg. Haiti.
normalis Chapuis. Antilles.

Baliosus *Weise.*

parvulus Chapuis. Antilles.

Octotoma *Suffrian.*

gundlachi Suffrian. Cuba.

Ochthispa *Chapuis.*

gibba Olivier. Haiti.
loricata Weise. Porto Rico.
pulchella Suffrian. Cuba.
tricolor Suffrian. Cuba.

Pentispa *Chapuis.*

cristata Chapuis. Antilles.

Oncocephala *Chevrolat.*

tuberculata Olivier. Jamaica?

Porphyraspis *Hope.*

gundlachi Boheman. Cuba.
fallax Suffrian. Cuba.
palmarum Boheman. Haiti.
xanthocera Boheman. Cuba.

Tauroma *Hope.*

taurus Fabricius. Cuba.

Dolichotoma *Hope.*

chloris Hope. St. Vincent?

Elytrogona *Boheman.*

baccha Boheman. Haiti.
bulla Boheman. ?
interjecta Boheman. Haiti.
quadrimaculata Latreille (*ampulla* Boh). Haiti, Cuba.

Mesomphalia *Hope.*

ænea Olivier. Guadeloupe.
exclamationis Linné. Trinidad, Grenada, St. Vincent, Grenadines, Union, Martinique, Guadeloupe, Porto Rico.

Chelymorpha *Boheman.*

angusticollis Suffrian. Cuba.
argus Lichtenst. var: *geniculata* Dejean Cat. Porto Rico, Cuba.
cribraria Fabricius. Guadeloupe.
fimbrialis Suffrian. Cuba.
flavicollis Boheman. Cuba.
lurida Suffrian. Cuba.
polysticha Boheman. Grenada, St. Vincent, Guadeloupe, Porto Rico.
swarzi Thunberg. Jamaica.

Selenis *Hope.*

spinifex Linné. Guadeloupe.

Omoplata *Hope.*

distincta Boheman. Guadeloupe.

Batonota *Hope.*

aculeata Boheman. Haiti.
humeralis Olivier. Haiti.
lerouxi Boheman. Cuba.
turrifera Boheman. Haiti.

Eurypepla *Boheman.*

jamaicensis Linné. Antilles.
vitrea Boheman. Cuba.
brevilineata Boheman. Jamaica.

Aspidomorpha *Hope.*

bajula Boheman. Antilles.

Asteriza *Boheman.*

flavicornis Olivier. Haiti.

Coptocycla *Boheman.*

judaica Fabricius. Grenada, St. Vincent.
bicolor Fabricius (= *aurichalcea* Boh.) Grenada, St. Vincent, Grenadines, Becquia.
bistripunctata Olivier. Guadeloupe.
bisbinotata Boheman. Porto Rico, Cuba.
conflagrata Boheman. Cuba.
congregata Boheman. Cuba.
connectens Boheman. Cuba.
contemta Boheman. Cuba.
dorsopunctata Boheman. Cuba.
glabricula Boheman. Haiti.
glaucina Boheman. Porto Rico.
glyphica Boheman. Cuba.
guadeloupensis Boheman. St. Vincent, Grenadines, Mustique, Guadeloupe.
guttata Olivier. Guadeloupe, Porto Rico, Cuba.
hamulata Boheman. Haiti.
latevittata Boheman. St. Thomas.
oblita Suffrian. Cuba.
præusta Boheman. Haiti.
quadrisignata Boheman. Cuba.
repudiata Suffrian. Cuba.
subsignata Boheman. Antilles.

Family LII. BRUCHIDÆ.

Pachymerus *Thunberg.*

gleditsiæ Linné (*arthriticus* Fab.). Cuba.
sp. ? Jamaica.
giganteus Chevrolat (*?curvipes* Fåhr.) Porto Rico, Cuba.

Pseudopachymerus *Pic.*

incrustatus Gyllenhal. Antilles.
podagricus Fabricius. St. Bartholomew.

Bruchus *Linné.*

centromaculatus Allard (*?cinerifer* Sch.). Porto Rico, Cuba.
chinensis Linné (*pectinicornis* Linné). Cuba.
dominicanus Jekel. Haiti.
fallax Boheman. Jamaica.
flavescens Fåhraeus. St. Vincent.
lherminieri Fåhraeus. Guadeloupe.
livens Suffrian. Cuba.
mimosæ Fabricius. Haiti, Cuba.
obsoletus Say. Bahamas.
pisorum Linné (*pisi* Linné). Cuba.
pantherinus Suffrian. Cuba.
quadratus Suffrian. Cuba.
quadrimaculatus var: *barbicornis* Fab. Porto Rico, Cuba.
relictus Suffrian. Cuba.
rufimanus Schönherr. Cuba.
sinuatus Fåhraeus. Cuba.
spinosus Fabricius. Jamaica.
strigatus Motschulsky. Antilles.
tetricus Gyllenhal. Haiti, Jamaica.
tricolor Suffrian. Cuba.
xanthopus Suffrian. Cuba.

Spermophagus *Schönherr.*

affinis Motschulsky. Cuba.
cistelinus Gyllenhal. Cuba.
hoffmanseggi Gyllenhal (*robiniæ* Fab.). Haiti.
pygidialis Suffrian. Cuba.
sallei Jekel. Haiti.
semifasciatus Boheman. St. Bartholomew.
simulator Jacquelin Duval. Cuba.
subfasciatus Boheman. Cuba.
subsignatus Gyllenhal. Antilles.
tæniatus Suffrian. Cuba.

Family LIII. TENEBRIONIDÆ.

Trientoma *Solier.*

convexipennis Allard. ?
guadeloupensis Fleutiaux. Guadeloupe.
lævis Allard. Haiti.
martinicensis Allard. Martinique.
rugifrons Champion. Haiti.
ryticephala Allard. Haiti.
sallei Kraatz. Haiti.
varvasi Solier. Cuba.
wickhami Casey. Bahamas.

Epitragus *Latreille.*

exaratus Champion. Grenadines, Becquia, Union, Mustique.
aurulentus Kirsch. Jamaica.
jamaicensis Champion. Jamaica.

Schœnicus *Leconte.*

antillarum Champion. Grenada, St. Vincent.
brunneus Champion. St. Vincent.

Meralius *Casey.*

echinatum Guérin. Cuba.

Dacoderus *Leconte.*

dominicensis Horn. Haiti.

Branchus *Leconte.*

woodi Leconte. Bahamas.

Cœlotaxis *Horn.*

angustula Casey. Guadeloupe.
densa Casey. Guadeloupe.
frontalis Casey. Guadeloupe.
muricata Horn. Guadeloupe.
punctulata Horn. Guadeloupe.

Platylus *Mulsant & Rey.*

dilatatus Fabricius. St. Thomas.

Diastolinus *Mulsant & Rey.*

clavatus Mulsant. St. Thomas.
costipennis Mulsant. Haiti.
fuscicornis Chevrolat. Porto Rico.
puncticollis Mulsant. Haiti.
perforatus Sahlberg. Martinique, Guadeloupe, St. Bartholomew.
sallei Mulsant. Haiti.
waterhousei Mulsant. Cuba.

Hopatrinus *Latreille.*

gemellatus Olivier. Grenada, St. Vincent, Grenadines, Becquia, Mustique, Union, Antigua, Guadeloupe.

pullus Sahlberg (*anthracinus* Muls.). Jamaica, Cuba.

Cenophorus *Mulsant & Rey.*

viduus Mulsant. Haiti.

Ctesicles *Champion.*

maritimus Champion. Grenada, Grenadines, Mustique.

insularis Champion. St. Vincent.

Blapstinus *Latreille.*

fortis Leconte (*Hopatrinus* (*interstitialias* Chev.) *punctulatus* Jacq. Duv.). Cuba.

insularis Champion. Tobaga.

opacus Mulsant. Guadeloupe.

punctatus Fabricius. Antilles.

puncticeps Mulsant. Cuba.

striatulus Mulsant. Antilles.

Conibius *Leconte.*

guadeloupensis Casey. Guadeloupe.

Sellio *Mulsant & Rey.*

tibidens Quensel. Antilles.

coarctatus Mulsant. Haiti.

Scaptes *Champion.*

tropicus Kirsch (*squamulatus* Champ.). Guadeloupe.

ciliatus Champion. St. Vincent.

Trachyscelis *Latreille.*

aphodioides Latreille. Guadeloupe.

Phaleria *Latreille.*

angustata Chevrolat. Guadeloupe, Haiti.

chevrolatii Fleutiaux. Grenada, Grenadines, Mustique, Guadeloupe.

fulva Fleutiaux. Grenada, Grenadines, Mustique, Guadeloupe.

guadeloupensis Fleutiaux. Guadeloupe.

sp. ? Bahamas.

Crypticus *Latreille.*

undatus Champion. Grenada, Grenadines, Mustique.

Ozolais *Pascoe.*

tuberculifera Champion. Grenada, St. Vincent.

Rhipidandrus *Leconte.*

micrographus Lacordaire. Guadeloupe.

Cherostus *Waterhouse.*

cornutus Arrow. Grenada, St. Vincent.
jamaicensis Arrow. Jamaica.

Eutomus *Lacordaire.*

sulcatus Gorham. St. Vincent.

Hoplocephala *Castelnau & Brullé.*

capra Castelnau & Brullé. Jamaica.
cornigera Fabricius. Cuba.
ferrugineus Leconte. Cuba.
suilla Champion. St. Vincent, Guadeloupe.

Platydema *Castelnau & Brullé.*

antennatum Castelnau & Brullé. Cuba.
apicale Castelnau & Brullé. Cuba.
apicenotatum Champion. Grenada.
basicorne Chevrolat. Cuba.
diophthalmum Castelnau & Brullé. Cuba.
excavatum Say (*tuberculatum* Cast.). Cuba.
filicorne Chevrolat. Jamaica.
flexuosum Chevrolat. Cuba.
piliferum Champion. St. Vincent.
punctatostriatum Chevrolat. Cuba.
virens Castelnau & Brullé. Cuba.
scriptipenne Fairmaire. Grenada.

Menimopsis *Champion.*

excæcus Champion. St. Vincent.

Gnathocerus *Thunberg.*

maxillosus Fabricius. Grenada, Cuba.

Iccius *Champion.*

rufotestaceus Champion. St. Vincent.
grenadensis Champion. Grenada.

Tribolium *MacLeay.*

ferrugineum Fabricius. Grenada, St. Vincent, Guadeloupe.

Alegoria *Castelnau.*

dilatata Castelnau. Grenada, St. Vincent.
castelnaui Fleutiaux. Gaudeloupe.

Antimachus *Gistler.*

roudeni Petit. Guadeloupe.

Arrhabæus *Champion.*

debilis Champion. Grenada, St. Vincent.
guadeloupensis Fleutiaux. Guadeloupe.

Uloma *Castelnau.*

antillarum Champion. Grenada.
grenadensis Champion. Grenada.
parvula Champion. St. Vincent.
retusa Fabricius. Guadeloupe.
sulcata Champion. St. Vincent.

Alphitobius *Stephens.*

piceus Olivier (cosmopolitan). St. Vincent, Antigua, Guadeloupe.

Sitophagus *Mulsant.*

hololeptoides Castelnau. Guadeloupe, Porto Rico, Cuba.

Doliema *Pascoe.*

plana Fabricius. Grenadines, Mustique, Guadeloupe, Cuba.

Ulosonia *Castelnau.*

tricornis Castelnau. Cuba.

Hypophloeus *Fabricius.*

rufipes Fabricius. Guadeloupe.

Zophobas *Blanchard.*

morio Fabricius. Trinidad, St. Vincent, Dominica, Guadeloupe, Jamaica, Cuba,

laticollis Motschulsky. Grenada.

rugipes Kirsch. Porto Rico, Guadeloupe.

Hesiodus *Champion.*

caraibus Fleutiaux. Guadeloupe.

Tauroceras *Hope.*

cornutum Fabricius. Jamaica.

Glyptotus *Leconte.*

cribratus Leconte. Bahama.

Lorelus *Sharp.*

brevicornis Champion. Grenada, St. Vincent.

Lorelopsis *Champion.*

pilosus Champion. St. Vincent.

Anædus *Blanchard.*

quadrinotatus Champion. Grenada, St. Vincent.

Paratenetus *Spinola.*

punctulatus Champion. Grenada.

Cyrtosoma *Perty.*

lherminieri Chevrolat. Grenada, St. Vincent, Guadeloupe.

?piceum Castelnau & Brullé. Guadeloupe.

Cnodalon *Latreille.*

viride Latreille. Haiti.

Blapida *Perty.*

castaneipennis Champion. Trinidad, Grenada.

Acropteron *Perty.*

quadraticolle Champion. Grenada, St. Vincent.
chabrieri Fleutiaux. Guadeloupe.

Nautes *Pascoe.*

azurascens Jacquelin, Duval. Cuba.
asperipennis Allard. Cuba.
rufipes Allard. Cuba.

Tarpela *Bates.*

granulipennis Jacquelin Duval. Cuba.
mutabilis Waterhouse. Jamaica.
propinqua Waterhouse. Jamaica.

Mentes *Champion.*

æneopiceus Champion. Grenadines, Mustique.

Talanus *Maeklin.*

cribrarius Jacquelin Duval. Grenada, Cuba.
ferrugineus Champion. Grenada, St. Vincent.
guadeloupensis Fleutiaux. Guadeloupe.
insularis Maeklin. Grenada.
lævicollis Champion. Grenada, St. Vincent.

Pyanisia *Castelnau.*

uniformis Waterhouse. Jamaica.
undata Fabricius. Guadeloupe.
tristis Castelnau (*unicolor* Solier). Cuba.

Strongylium *Kirby.*

amethystinum Guérin. Cuba.
antennale Maeklin. Cuba.
azureum Germar. Cuba.
chalcoptarum Maeklin. Martinique.
delauneyi Fleutiaux. Guadeloupe.
eximium Maeklin. Cuba.
guadeloupense Gebien (*inæquale* Fleut.). Guadeloupe.
pulvinatum Maeklin. Porto Rico.

Rhacius *Champion.*

sulcatus Dejean. Cuba.

Family LIV. ALLECULIDÆ

(formerly CISTELIDÆ).

Lobopoda *Solier.*

ebenina Champion. Grenada.
tarsalis Fleutiaux. Guadeloupe.
insularis Champion. Grenadines, Mustique.

Allecula *Fabricius.*

flavipes Jacquelin Duval. Porto Rico, Cuba.

fuscula Schönherr. Porto Rico.

Isomera *Mulsant.*

sericea Say. Bahamas.

Lystronychus *Latreille.*

delauneyi Fleutiaux. Guadeloupe.

rufonotatus Champion. St. Vincent.

tuberculifer Champion. Grenada.

Family LV. LAGRIIDÆ.

Statira *Serville.*

antillarum Champion. Grenada, Grenadines, St. Vincent, Mustique.

fulva Fleutiaux. Guadeloupe.

vittata Champion. St. Vincent, Grenadines, Mustique.

Family LVI. MONOMMIDÆ.

Hyporrhagus *Thomson.*

æneus Thomson. Haiti.

marginatus Fabricius. Cuba.

Family LVII. MELANDRYIDÆ.

Cteniacantha *Quedenfeldt.*

marginata Quedenfeldt. Porto Rico.

Family LVIII. PYTHIDÆ.

Sosthenes *Champion.*

parvulus Champion. Grenada.

sp. ? Guadeloupe.

Family LIX. OEDEMERIDÆ.

Nacerdes *Schmidt.*

melanura Linné. Bahamas.

Copidita *Leconte.*

costata Champion. St. Vincent?

elegans Waterhouse. Haiti.

frontalis Champion. St. Vincent.

grenadensis Champion. Grenada.

lateralis Waterhouse. Grenada, Grenadines, Mustique, Haiti, Jamaica.

læta Waterhouse. Haiti.

lineata Waterhouse. Jamaica.

quadrilineata Champion. St. Vincent.

rubricollis Waterhouse. St. Thomas.

tenella Waterhouse. St. Vincent, St. Thomas.

Oxacis *Leconte.*

simplex Waterhouse. Grenadines, Mustique, St. Bartholomew, Antigua, St. Vincent.

dorsalis Melsheimer. Bahamas.

antillarum Champion. St. Vincent.

geniculata Chevrolat. Porto Rico.

Ischnomera *Stephens.*

suturalis Fleutiaux. Guadeloupe.

testaceicollis Jacquelin Duval. Cuba.

thoracica Fleutiaux. Guadeloupe.

Ananca *Fairmaire.*

vittata Fabricius. Guadeloupe, Porto Rico.

Family LX. MORDELLIDÆ.

Mordella *Linné.*

sexguttata Champion. Grenada, St. Vincent.

basifulva Quedenfeldt. Porto Rico.

leucocephala Quedenfeldt. Porto Rico.

?scutellaris Fabricius. Porto Rico.

Mordellistena *Costa.*

pallida Champion. St. Vincent, Antigua, Guadeloupe.

annuliventris Quedenfeldt. Porto Rico.

ferruginea Fabricius. St. Thomas, Porto Rico.

signaticollis Quedenfeldt. Porto Rico.

Conalia *Mulsant.*

ebenina Champion. Grenadines, St. Vincent, Mustique.

fulvoplagiata Champion. Grenada.

Family LXI. PEDILIDÆ.

(formerly part of ANTHICIDÆ).

Macrataria *Newman.*

femoralis Champion. St. Vincent.

insularis Laferte. Cuba.

Family LXII. ANTHICIDÆ.

Notoxus *Geoffroy.*

monodon Fabricius. Antigua.

bipunctatus Chevrolat. Porto Rico

Anthicus *Paykull.*

floralis Paykull (cosmopolitan). Grenada, Guadeloupe, Porto Rico, Cuba.

trifasciatus Fabricius. Grenada, Grenadines, Mustique, St. Vincent, St. Thomas, Guadeloupe.

grenadensis Champion. Grenada.

sulcipennis Champion. St. Vincent.

vicinus Laferte (*fulvomicans* Qued.). Porto Rico.

Family LXIII. HYLOPHILIDÆ
(formerly part of ANTHICIDÆ).

Hylophilus *Berthold.*

æquinoctialis Champion. St. Vincent.
atriceps Pic (*nigricollis* Champ.). Grenada.
guttatus Champion. Grenada, St. Vincent.
trifasciatus Champion. Grenada.

Family LXIV. MELOIDÆ.

Meloe *Linné.*

barranci Dugès (*lævis* Leach). Haiti.

Horia *Fabricius.*

maculata Swederer. Trinidad, Guadeloupe, Haiti.
auriculata Dugès. Barbados.

Tetraonyx *Latreille.*

cubensis Chevrolat. Cuba.
cruciatus Castelnau. Haiti.
quadrimaculatus Fabricius. Grenada, St. Vincent, St. Thomas, Guadeloupe, Porto Rico, Cuba.

Cantharis *Linné.*

annulicornis Chevrolat. Porto Rico.
delauneyi Fleutiaux. Guadeloupe.
obscuricornis Chevrolat. Porto Rico.

Zonitis *Fabricius.*

lineata Champion. Grenada.

Nematognatha *Illiger.*

cubæcola Jacquelin Duval. Cuba.

Family LXV. RHIPIPHORIDÆ.

Macrosiagon *Hentz.*

basalis Gerstaecker. Porto Rico.
discicolle Gerstaecker var: *melanoptera* Chevrolat. Porto Rico.
discicolle Gerstaecker var: *quadrimaculatum* Gerstaecker (*vitraci* Fleut.). Guadeloupe, Cuba.
discicolle Gerstaecker var: *mutilatum* Gerstaecker Columbia. Porto Rico(?)
octomaculatum Gerstaecker. St. Vincent, Guadeloupe.
spinosum Fabricius. Antilles.

Rhipiphorus *Fabricius.*

sordidum Gerstaecker var: *major* Quedenfeldt. Porto Rico.

Rhipidophorus *Bosc.*

sancti-vincentis Champion. St. Vincent.

Family LXVI. CURCULIONIDÆ.

Acamptopsis *Champion.*

cubanus Champion. Cuba.

Pandeletejus *Schönherr.*

sublineatus Champion. Grenada, St. Vincent.

Polydacrys *Schönherr.*

modestus Gyllenhal. Cuba.
var: *nigrosparsus* Chevrolat. Guadeloupe.
var: *mæstus* Chevrolat. Guadeloupe.
depressifrons Boheman. Grenada, St. Vincent.

Apotomoderes *Schönherr.*

lateralis Gyllenhal. Haiti.

Pachneus *Schönherr.*

azurescens Gyllenhal. Cuba.
costatus Perroud. Cuba.
litus Germar. Jamaica, Cuba.
psittacus Olivier. Haiti.
roseipes Chevrolat. Porto Rico.
sp. ? Bahamas.

Neocyphus *Bedel.*

gentilis Olivier. Guadeloupe.
pudens Boheman. St. Bartholomew.
strangulatus Chevrolat. Guadeloupe.
var: *leucocephalus* Chevrolat. Guadeloupe, Antigua.

Oxyderes *Schönherr.*

cretaceus Fabricius. Guadeloupe.
lacteus Fabricius. Guadeloupe.

Compsus *Schönherr.*

depressicollis Gyllenhal. Haiti.
hybridus Rosenschoeld. Guadeloupe.
leucogæus Germar. Haiti.
maugéi Boheman. Antilles.
viridans Boheman. St. Thomas.

Diaprepes *Schönherr.*

abbreviatus Linné. Barbados, Guadeloupe.
comma Boheman. Porto Rico, Haiti.
distinguendus Boheman. Porto Rico, Guadeloupe.
marginicollis Chevrolat. Guadeloupe.
purvesi Roeloffs. Antigua.
rufescens Boheman. Guadeloupe.
v itraci Fleutiaux. Guadeloupe.

Propodes *Schönherr.*

amabilis Waterhouse. Jamaica.
quindecimpunctatus Olivier. Porto Rico.

Exophthalmus *Schönherr.*

albosquamosus Sallé. Haiti.
aurarius Gyllenhal. Guadeloupe.
cinerascens Fabricius. Antilles.
costatus Gyllenhal. Haiti.
doublieri Guérin. Haiti.
elegans Guérin. Cuba.
elegantulus Gyllenhal. Martinique.
esuriens Gyllenhal. St. Bartholomew.
excavatus Rosenschoeld. St. Vincent.
famelicus Olivier. Guadeloupe.
glaucus Olivier. Antilles.
haitiensis Bovie. Haiti.
hieroglyphicus Chevrolat. Haiti.
hybridus Chevrolat. Cuba.
impressus Fabricius. Jamaica.
inæqualis Gyllenhal. Haiti.
jamaicensis Bovie. Jamaica.
laetus Olivier. Haiti.
lepidus Chevrolat. Cuba.
leucopterus Gyllenhal. Haiti.
luctuosus Gyllenhal. Cuba.
martinicensis Chevrolat. Martinique.
maculosus Chevrolat. Cuba.
mannerheimi Boheman. Haiti.
marginatus Olivier. Guadeloupe.
marmoreus Gyllenhal. Guadeloupe.
novemdecimpunctatus Fabricius. Antilles.
obsoletus Olivier. Haiti.
olivieri Chevrolat. Haiti.
pictus Guérin. Cuba.
pugnax Olivier. Antilles.
pulcher Brown. Jamaica.
quadritaenia Chevrolat. Guadeloupe.
quadrivittatus Olivier. Haiti.
var: *biguttatus* Fabricius. St. Thomas.
regalis Linné. Haiti.
rohri Fabricius. Antilles.
scalaris Boheman. Cuba.
similis Drury. Jamaica.
sommeri Rosenschoeld. Cuba.
spengleri Linné. Porto Rico.
sphacelatus Olivier. Jamaica, Haiti.
squamipennis Germar. Haiti.
sulphuratus Chevrolat. Cuba.
tredecim-maculatus Guérin. Cuba.
vittatus Linné. Jamaica.

Lachnopus *Schönherr.*

acuticollis Gyllenhal. Cuba.
æreus Gyllenhal. Haiti.
albomaculatus Gyllenhal. Haiti.
argus Reiche. Cuba.
atramentarius Gyllenhal. Haiti.
aulicus Gyllenhal. Haiti.
aurifer Drury. Jamaica.
calcaratus Olivier. Antilles.
campechianus Gyllenhal. Guadeloupe.
canescens Gyllenhal. Haiti.
chirographus Olivier. Antilles.
chlorophanus Gyllenhal. Haiti.
consentaneus Perroud. Haiti.
curvipes Fabricius. St. Vincent, St. Bartholomew, Guadeloupe, Jamaica, Porto Rico.
dentipes Perroud. Haiti.
granicollis Gyllenhal. Haiti.
guerini Jacquelin Duval. Cuba.
hirtus Perroud. Haiti.
hispidus Gyllenhal. Cuba.
inconditus Rosenschoeld. Haiti.
interruptus Perroud. Haiti.
lineatoguttatus Perroud. Cuba.
lineicollis Chevrolat. Guadeloupe.
memnonius Gyllenhal. St. Bartholomew.
mercator Olivier. Haiti.
multipunctatus Jacquelin Duval. Cuba.
mundus Gyllenhal. Haiti.
nivei-irroratus Jacquelin Duval. Cuba.
planifrons Gyllenhal. Haiti.
plebejus Gyllenhal. Haiti.
plumipes Perroud. Haiti.
pollinarius Gyllenhal. Cuba.
proteus Olivier. Haiti.
pruinosus Gyllenhal. Haiti.
seriepunctatus Jacquelin Duval. Cuba.
sparsimguttatus Perroud. Cuba.
splendidus Boheman. Cuba.
spretus Gyllenhal. Haiti.
sublineatus Perroud. Cuba.
trilineatus Chevrolat. Porto Rico.
valgus Fabricius. St. Bartholomew.
villosipes Boheman. St. Eustatius.
vittatus Gyllenhal. Cuba.

Ischionoplus *Chevrolat.*

niveoguttatus Chevrolat. Cuba.
viridiguttatus Chevrolat. Haiti.

Tetrabothymus *Labram & Imhoff*

spectabilis Gyllenhal. Cuba.

Artipus *Schönherr.*

alboscutellatus Chevrolat. Guadeloupe.
corycaeus Sahlberg. St. Bartholomew.
grisescens Chevrolat. Jamaica.
porosicollis Chevrolat. Isle of Pines.
psittacinus Gyllenhal. Haiti.
unguiculatus Chevrolat. Cuba.
sp. ? Bahamas.

Brachyomus *Lacordaire.*

alternans Boheman. Cuba.
aureosquamosus Jacquelin Duval. Cuba.
irregularis Perroud. Cuba.
robustus Perroud. Cuba.
tuberculatus Boheman. St. Vincent.

Eustylus *Pascoe.*

hybridus Rosenschoeld. Guadeloupe.

Hormotrophus *Schönherr.*

aureomixtus Boheman. Haiti.

Hypsonotus *Germar.*

latus Jekel. St. Vincent.

Anchonus *Schönherr.*

angulicollis Chevrolat. Porto Rico.
aspericollis Suffrian. Cuba.
bicornis Suffrian. Cuba.
caveatus Fåhraeus. Guadeloupe.
clathratus Fåhraeus. Guadeloupe.
cribricollis Coquerel. Martinique.
delauneyi Chevrolat. Guadeloupe.
denticulatus Chevrolat. Guadeloupe.
guildingi Fåhraeus. St. Vincent.
hopei Fåhraeus. St. Vincent, Guadeloupe.
impressus Fåhraeus. St. Vincent, Guadeloupe.
inaequalis Fåhraeus. Guadeloupe.
incrassatus Suffrian. Isle of Pines, Cuba.
indus Fåhraeus. St. Vincent, Guadeloupe.
interruptus Fåhraeus. Guadeloupe.
lafertei Fåhraeus. Martinique.
leprosus Chevrolat. Guadeloupe.
lherminieri Chevrolat. Guadeloupe.
magister Faust. Antigua.
piliger Chevrolat. Guadeloupe.
plicaticollis Chevrolat. Guadeloupe.
pudens Faust. Guadeloupe.
rufescens Chevrolat. Guadeloupe.
rusticus Suffrian. Cuba.
serietuberculatus Fåhraeus. Guadeloupe, Martinique.
serratus Fabricius. St. Thomas.
suillus Fabricius. Guadeloupe, Cuba.
trossulus Chevrolat. Guadeloupe.
var: *cirriger* Chevrolat. Guadeloupe.

Anephilus *Faust.*

guadulpianus Faust. Guadeloupe.

Eugnathus *Schönherr.*

squamifer Boheman. Cuba.

Promecops *Schönherr.*

cognata Fåhraeus. St. Vincent.
lunata Fåhraeus. St. Vincent.
postica Fåhraeus. Guadeloupe.

Cephalalges *Schönherr.*

cubæ Guérin. Cuba.
murinus Boheman. Haiti.

Lixus *Fabricius.*

merula Suffrian. Cuba.
tardus Suffrian. Cuba.

Sternuchus *Schönherr.*

insularis Boheman. Cuba.
vicinus Fleutiaux. Guadeloupe.

Hiliplus *Germar.*

guttatus Boheman. Haiti, Cuba.
latro Gyllenhal. Guadeloupe.
rusticus Boheman. Cuba.
sinuatus Boheman. Guadeloupe.
tripunctatus Chevrolat. Guadeloupe.
ustulatus Olivier. Porto Rico.

Ephimerus *Schönherr.*

sexguttatus Boheman. Jamaica.

Hydronomus *Schönherr.*

argillaceus Suffrian. Cuba.
brevirostris Suffrian. Cuba.
peregrinus Suffrian. Cuba.
tessulatus Suffrian. Cuba.

Smicronyx *Schönherr.*

albosignatus Suffrian. Cuba.

Phyllotrox *Schönherr.*

pallidus Fåhraeus. St. Vincent, Guadeloupe.
liturellus Suffrian. Cuba.
variegatus Suffrian. Cuba.

Ambates *Schönherr.*

lateralis Champion. St. Vincent.

Rhopalotria *Chevrolat.*

dimidiata Chevrolat. Cuba.

Attelabus *Linné.*

angulosus Gyllenhal. Cuba.
armatus Gyllenhal. Haiti, Cuba.
aureolus Gyllenhal. Cuba.
bipustulosus Jekel. Jamaica.
canaliculatus Olivier. Haiti.
cribrarius Olivier. Haiti.
dentipes Fabricius. Antilles.
var: *anserinus* Germar. Jamaica.
fornicatus Olivier. Haiti.
foveipennis Suffrian. Cuba.
?mutabilis Jekel. St. Paul.
pulchellus Suffrian. Cuba.
scutellatus Gyllenhal. Cuba.
sexmaculatus Chevrolat. Porto Rico

Rhynchites *Herbst.*

trifasciatus Suffrian. Cuba.

Ludovix *Castelnau.*

morio Suffrian. Cuba.

Otidocephalus *Chevrolat.*

formicarius Olivier. Haiti.
poeyi Chevrolat. Cuba.
pulicarius Boheman. Porto Rico.
simplex Suffrian. Cuba.

Erodiscus *Schönherr.*

delauneyi Chevrolat. Guadeloupe.

Lonchophorus *Chevrolat.*

humeralis Chevrolat. Cuba.
petiminosus Germar. Cuba.

Botanobius *Schönherr.*

tuberculatus Gyllenhal. Cuba.

Anthonomus *Germar.*

alboannulatus Boheman. Guadeloupe, Cuba.
annulipes Fischer. Porto Rico.
argentatus Gyllenhal. St. Bartholomew.
bidentatus Boheman. St. Vincent.
costulatus Suffrian. Cuba.
dentipennis Chevrolat. Porto Rico.
flavescens Boheman. Guadeloupe.
flavus Boheman. Guadeloupe.
grandis Boheman. Cuba.
homunculus Gyllenhal. Guadeloupe.
infirmus Gyllenhal. St. Bartholomew.
krugii Fischer. Porto Rico.
macromalus Gyllenhal. St. Bartholomew.
modicellus Gyllenhal. Martinique, Guadeloupe, Cuba.
luteus Suffrian. Cuba.
morbillosus Suffrian. Cuba.
nanus Gyllenhal. Haiti.
nigrovariegatus Fischer. Porto Rico.
posthumus Suffrian. Cuba.
pulchellus Suffrian. Cuba.
pulicarius Boheman. Porto Rico.
punctipennis Gyllenhal. Cuba.
pusio Gyllenhal. St. Bartholomew.
rhamphoides Suffrian. Cuba.
rufirostris Gyllenhal. Martinique, Guadeloupe.
suturellus Gyllenhal. Martinique, Cuba.
testaceus Boheman. St. Vincent, Guadeloupe, Cuba.
tigrinus Suffrian. Cuba.
variegatus Suffrian. Cuba.

Hamaba *Casey.*

bahamensis Casey. Bahama.
dispersa Casey. Bahama.

Prionomerus *Schönherr.*

triangulifer Chevrolat. Guadeloupe.

Tychius *Schönherr.*

auricapillus Suffrian. Cuba.
discoloma Suffrian. Cuba.

Cholus *Germar.*

biinterruptus Desbrochers. Antilles.

Polyderces *Schönherr.*

zonatus Swederer. Guadeloupe.

Homalonotus *Schönherr.*

lherminieri Chevrolat. Guadeloupe.

Conotrachelus *Schönherr.*

amœnus Chevrolat. Guadeloupe.
cristatus Fåhraeus. Guadeloupe.
diaconitus Boheman. Cuba.
lassulus Boheman. Cuba.
maceritiæ Fåhraeus. Gaudeloupe.
marginiceps Chevrolat. Guadeloupe.
niveiceps Chevrolat. Guadeloupe.
ocularis Chevrolat. Guadeloupe.
ruber Chevrolat. Guadeloupe.
scapularis Chevrolat. Guadeloupe.
serpentinus Boheman. Jamaica, Cuba.
serripennis Chevrolat. Guadeloupe.
verticalis Boheman. Cuba.

Cleogonus *Schönherr.*

fairmairei Coquerel. Martinique.
proximus Chevrolat. Haiti.
trochilus Olivier. Haiti.

Rhyssomatus *Schönherr.*

aciculaticollis Boheman. Haiti.
crispicollis Boheman. Cuba.
nigerrimus Gyllenhal. St. Vincent, Martinique.

Chalcodermus *Schönherr.*

angularis Champion. St. Vincent.
ebeninus Boheman. Cuba.
insularis Chevrolat. Guadeloupe.

Guioperus *Perty.*

klugi Gerstaecker. St. John.

Nettarhinus *Schönherr.*

bilobus Olivier. Haiti.
mannerheimi Boheman. Porto Rico.

Acalles *Schönherr.*

apicalis Boheman. Cuba.
clunaris Chevrolat. Guadeloupe.
errans Boheman. Guadeloupe.
gonoderus Chevrolat. Guadeloupe.
scapularis Chevrolat. Guadeloupe.
solidus Chevrolat. Guadeloupe.

Tylodes *Schönherr.*

bullatus Boheman. Cuba.
laticollis Boheman. Cuba.
neglectus Chevrolat. Guadeloupe.
quadriplicatus Jacquelin Duval. Cuba.
subfasciatus Rosenschoeld. Guadeloupe.

Lembodes *Schönherr.*

solitarius Boheman. Guadeloupe, Cuba.
ulula Chevrolat. Haiti.

Ulosomus *Schönherr.*

crassirostris Chevrolat. Guadeloupe.
erinaceus Boheman. St. Bartholomew.
immundus Boheman. Cuba.
setosus Boheman. St. Vincent.

Euscepes *Schönherr.*

frontalis Chevrolat. Haiti.
hirsutus Chevrolat. Guadeloupe.
interstitialis Chevrolat. Guadeloupe.
orthodoxus Chevrolat. Guadeloupe.
pilosellus Chevrolat. Guadeloupe.
porcellus Boheman. Porto Rico, Cuba.
tonsus Chevrolat. Guadeloupe.
ursus Chevrolat. Guadeloupe.

Oxypterus *Faust.*

obliquevittis Faust. Guadeloupe.

Pseudomus *Schönherr.*

apiatus Boheman. Cuba.
cacuminatus Boheman. Cuba.
fistulosus Boheman. Cuba.
militaris Olivier. Antilles.
notatus Boheman. Cuba.
semicribratus Boheman. Guadeloupe.
viduus Boheman. Cuba.

Gasterocercus *Laporte and Brullé.*

nocturnus Chevrolat. Guadeloupe.
richteri Fischer. Porto Rico.
singularis Chevrolat. Guadeloupe.

Molicorynes *Waterhouse.*

longimanus Waterhouse. Jamaica.

Cryptorrhynchus *Illiger.*

batatæ Waterhouse. Barbados.
bufonius Jacquelin Duval. Cuba.
capucinus Chevrolat. Guadeloupe.
cingulum Gyllenhal. Guadeloupe.
claviger Chevrolat. Guadeloupe.
clericus Chevrolat. Guadeloupe.
corticalis Boheman. St. Vincent, Guadeloupe.
cubæ Boheman. Cuba.
decimguttatus Chevrolat. Guadeloupe.
dentatus Chevrolat. Guadeloupe.
difficilis Boheman. Cuba.
dimidiatus Boheman. Cuba.
frontalis Boheman. Cuba.
impuratus Boheman. Jamaica.
infernalis Chevrolat. Guadeloupe.
insularis Rosenschoeld. Guadeloupe.
levidipus Boheman. Cuba.
nodulosus Chevrolat. Guadeloupe.
otiosus Boheman. Haiti.
quadrifoveatus Chevrolat. Antilles.
quadripunctatus Chevrolat. Guadeloupe.
ravus Boheman. Cuba.
sexcostatus Chevrolat. Guadeloupe.
vacillatus Boheman. St. Vincent.
var: *leporinus* Chevrolat. Guadeloupe.
var: *delumbatus* Rosenschoeld. Guadeloupe.
var: *ornatipennis* Chevrolat. Guadeloupe.

Discophorus *Chevrolat.*

bicirculus Kirsch. Cuba.
circulus Boheman. Cuba.

Graphonotus *Chevrolat.*

guadelupensis Rosenschoeld. Guadeloupe.
balteatus Sahlberg. St. Bartholomew.

Cœlosternus *Schönherr.*

alternans Boheman. Guadeloupe.
armipes Boheman. St. Vincent, Guadeloupe.
aurulentus Chevrolat. Guadeloupe.
basalis Chevrolat. Guadeloupe.
crucifer Chevrolat. Guadeloupe.
grisescens Chevrolat. Guadeloupe.
polyclais Chevrolat. Guadeloupe.

Cylindrocorynus *Schönherr.*

thoracicus Chevrolat. Guadeloupe.

Hammacerus *Chevrolat.*

delauneyi Chevrolat. Guadeloupe.

Macromerus *Schönherr.*

clavipes Boheman. Cuba.
cultricollis Chevrolat. Guadeloupe.
lanipes Olivier. St. Lucia, Guadeloupe.
lherminieri Boheman. Guadeloupe.

Copturus *Schönherr.*

lineolatus Chevrolat. Guadeloupe.
perturbatus Gyllenhal. Jamaica.

Trypetes *Schönherr.*

guildini Fåhraeus. St. Vincent.

Nanus *Schönherr.*

uniformis Boheman. Guadeloupe, Haiti, Porto Rico, Cuba.
erythrurus Chevrolat. Guadeloupe.

Pyropus *Schönherr.*

cyaneus Herbst. Jamaica.
sapphirinus Gyllenhal. Jamaica, Cuba.

Peridinetus *Schönherr.*

concentricus Olivier. Porto Rico, Haiti.
insignis Chevrolat. Guadeloupe.
maculatus Rosenschoeld. Cuba.
poeyi Jacquelin Duval. Cuba.
roeseli Boheman. Cuba.
signatus Rosenschoeld. Porto Rico, Cuba.

Diorygomerus *Schönherr.*

insolens Boheman. Jamaica.
substriatus Boheman. Cuba.

Pantoteles *Schönherr.*

variabilis Chevrolta. Guadeloupe.

Coleomerus *Schönherr.*

ebeninus Boheman. Antilles.

Diorymerellus *Champion.*

obliteratus Champion. St. Vincent.

Zaglyptoides *Champion.*

ferrugineus Champion. St. Vincent.

Zaglyptus *Leconte.*

quadriguttatus Champion. St. Vincent.

Limnobaris *Bedel.*

antillarum Champion. St. Vincent.

Baris *Germar.*

aerea Boheman. Grenada, St. Vincent.
auricoma Boheman. St. Vincent.
azurea Boheman. Cuba.
callaides Chevrolat. Guadeloupe.
chalybea Boheman. Cuba.
modica Boheman. Guadeloupe.
multistriata Chevrolat. Guadeloupe.
penicillata Boheman. Cuba.
quadrimaculata Boheman. Cuba.
rufipes Boheman. Guadeloupe.
scissa Chevrolat. Guadeloupe.
tabaci Sallé. Cuba.
torquatus Olivier. Porto Rico.

Centrinus *Schönherr.*

arcufascia Chevrolat. Guadeloupe.
ebeninus Boheman. Guadeloupe.
lanæfaucis Chevrolat. Guadeloupe.
penicellus Herbst var: *tomentosus* Klug. Cuba.
perscitus Herbst. Grenada.
politus Chevrolat. Guadeloupe.
pulchellus Chevrolat. Guadeloupe.
punctatissimus Boheman. Cuba.

Anotiscus *Desbrochers des Loges.*

umbilicatus Desbrochers. Guadeloupe.

Cyrionyx *Faust.*

alboguttatus Champion. St. Vincent.

Cylindrocerus *Schönherr.*

insularis Champion. St. Vincent.

Subfamily Apioninæ.

Cylas *Latreille.*

formicarius Fabricius. Jamaica, Cuba.

Apion *Herbst.*

macula-alba Suffrian. Cuba.
nigrosparsum Suffrian. Cuba.
portoricanum Gerstaecker. Porto Rico.
subæneum Gerstaecker. Porto Rico.
vestitum Gyllenhal. Haiti.

Family LXVII. BRENTHIDÆ.

Taphroderes *Schönherr.*

sexmaculatus Boheman. St. Vincent.

Stereodermus *Lacordaire.*

exilis Suffrian. Cuba.

Trachelizus *Schönherr.*

linearis Suffrian. Cuba.
simplex Suffrian. Cuba.
tenuis Suffrian. Cuba.
uncimanus Boheman. Cuba.

Arrhenodes *Schönherr.*

turbatus Gyllenhal. Haiti.

Estenorrhinus *Lacordaire.*

forcipitiger Gyllenhal. Cuba.

Belophorus *Schönherr.*

maculatus Oliver. Haiti, Porto Rico.
militaris Olivier. Cuba.
monilis Olivier. Haiti.
nasutus Fabricius. Jamaica, Haiti.
schœnherri Mannerheim. Haiti.
simplicicollis Suffrian. Cuba.
spinosus Gyllenhal. Haiti.
strigicollis Lac. Cuba.

Rhaphidorrhynchus *Schönherr.*

nitidicollis Gyllenhal. Guadeloupe.

Brenthus *Fabricius.*

anchorago Linné. Guadeloupe.
turbatus Boheman. Cuba.
volvulus Fabricius. Haiti, Cuba.
?vulneratus Schönherr.

Acratus *Lacordaire.*

monilis Fabricius. Antilles.
subfasciatus Boheman. Guadeloupe.

Ulocerus *Dalman.*

bicaudatus Suffrian. Cuba.

Family LXVIII. COSSONIDÆ

(formerly CALANDRIDÆ).

Rhynchophorus *Herbst.*

palmarum Linné. St. Vincent, Guadeloupe, Trinidad.

Scyphophorus *Schönherr.*

interstitialis Gyllenhal. Haiti.
acupunctatus Gyllenhal. Haiti, Cuba.

Metamasius *Horn.*

sericeus Olivier. Haiti, Cuba.
hemipterus Linné. St. Croix, Dominica. Antigua, Guadeloupe, Porto Rico, Jamaica, Barbados.

Sphenophorus *Schönherr.*

cornurostris Chevrolat. Guadeloupe.
fossor Gyllenhal. St. Vincent.
liratus Gyllenhal. Guadeloupe.
longicollis Olivier. Haiti.
maurus Gyllenhal. Martinique.
placidus Say. Cuba.
quadrisignatus Gyllenhal. Guadeloupe.
sordidus Germar. Guadeloupe.

Calandra *Clairville.*

linearis Herbst. St. Bartholomew, Jamaica, Cuba.
var: *striata* Thunberg. Guadeloupe.
oryzæ Linné. Antigua, Guadeloupe, Porto Rico.

Mesocordylus *Lacordaire.*

porriginosus Gyllenhal. Guadeloupe.

Rhina *Latreille.*

oblita Jacquelin Duval. Cuba.
scrutator Olivier. Haiti, Cuba.

Catolethrus *Schönherr.*

fallax Boheman. St. Vincent.

Stenotrupes *Wollaston.*

acicula Wollaston. Cuba.

Dryotribus *Horn.*

mimeticus Horn. Grenadines, Mustique.

Gononotus *Leconte.*

lutosus Leconte. Cuba.

Cossonus *Clairville.*

canaliculatus Fabricius. Porto Rico.
cubae Boheman. Cuba.
guildingi Boheman. St. Vincent.
hamiltoni Champion. Cuba.
impressus Boheman. Jamaica, Cuba.
scrobiculatostriatus Boheman. St. Vincent, Guadeloupe.
pyrirostris Boheman. Haiti.
spathula Boheman. Grenada, Jamaica, Cuba.
subcostatus Boheman. Cuba.
thoracica Boheman. St. Vincent.
vulneratus Illiger. Porto Rico.

Stenomimus *Wollaston.*

sp. ? Champion. Antilles.

Rhyncolus *Germar.*

elumbis Boheman. Grenada, Cuba.

Stenancylus *Casey.*

colomboi Casey. St. Vincent, Jamaica, Cuba.

Macrorhycolus *Wollaston.*

linearis Leconte. Grenada, Mustique, Grenadines.

Family LXIX. PLATYPODIDÆ

(formerly included in SCOLYTIDÆ).

Platypus *Herbst.*

apertus Chapuis. Guadeloupe.
areolatus Chapuis. Cuba.
erichsoni Chapuis. St. Thomas.
laevicollis Chapuis. Guadeloupe.
mulsanti Chapuis. Guadeloupe.
poeyi Guérin. Guadeloupe, Cuba.
schaumi Chapuis. Porto Rico.
subcostatus Jacquelin Duval. Guadeloupe, Porto Rico, Cuba.

Family LXX. IPIDÆ

(formerly SCOLYTIDÆ).

Hypothenemus *Westwood.*

eruditus Westwood. Nevis.
plumeriæ Nördlinger. Haiti.

Chramesus *Leconte.*

rotundatus Chapuis. Guadeloupe.

Cryphalus *Erichson.*

inops Eichhoff. Guadeloupe.
moschatus Schaufuss. Guadeloupe.
obscurus Ferrari. Cuba.
obscurus Eichhoff. Antilles.
setosus Eichhoff. Guadeloupe.

Ips *DeGeer.*

interstitialis Eichhoff. Jamaica.

Dryocoetes *Eichhoff.*

carbonarius Ferrari. Cuba.

Coccotrypes *Eichhoff.*

pygmæus Eichhoff. Haiti.

Pityophthorus *Eichhoff.*

concentralis Eichhoff. Cuba.

Pycnarthrum *Eichhoff.*

gracile Eichh (*hispidus* Ferrari). Cuba.
pallidus Chapuis. Guadeloupe.

Hexacolus *Eichhoff.*

glaber Eichhoff. Cuba.

Hylocurus *Eichhoff.*

alienus Eichhoff. Cuba.

Pagiocerus *Eichhoff.*

rimosus Eichhoff. Cuba.

Eccoptogaster *Herbst.*

dimidiatus Chapuis. Cuba.

Pterocyclon *Eichhoff.*

glabratus Ferrari. Guadeloupe.
mali Fitch. Cuba.

Xyleborus *Eichhoff.*

affinis Eichhoff. Barbados, Grenada, St. Vincent, Tobago, Nevis, Guadeloupe, Porto Rico, Cuba.
alternans Eichhoff. Haiti.
amplicollis Eichhoff. Porto Rico.
badius Eichhoff. Cuba?
capucinus Eichhoff. Guadeloupe.
ferrugineus Fabricius. Cuba.
confusus Eichhoff. Grenada, St. Vincent, Guadeloupe, Porto Rico.
fuscatus Eichhoff. Guadeloupe.
inermis Eichhoff. Guadeloupe.
posticus Eichhoff. Guadeloupe.
spinulosus Blandford. Grenada, Guadeloupe.
torquatus Eichhoff. Porto Rico, Cuba.

Family LXXI. ANTHRIBIDÆ.

Ptychoderes *Schönherr.*

angulatus Suffrian. Cuba.

Tropideres *Schönherr.*

angulatus Suffrian. Cuba.
balteatus Gyllenhal. Antilles.
confusus Suffrian. Cuba.
feralis Boheman. Cuba.
fuscipennis Suffrian. Cuba.
gracilicornis Suffrian. Cuba.
griseus Suffrian. Cuba.
luscus Fåhraeus. Cuba.
modestus Suffrian. Cuba.
obsoletus Suffrian. Cuba.
parvulus Suffrian. Cuba.
sexverrucatus Suffrian. Cuba.
sordidus Suffrian. Cuba.
variolosus Suffrian. Cuba.

Eugonus *Schönherr.*

dermestoides Suffrian. Cuba.

Toxonotus *Lacordaire.*

fascicularis Schönherr. Cuba.
trituberculatus Suffrian. Cuba.

Notioxenus *Wollaston.*

pallipes Suffrian. Cuba.

Aræocerus *Schönherr.*

lineicollis Chevrolat. Guadeloupe.

Neanthribius *Jordan.*

sp. ? Antilles.

Goniocloeus *Jordan.*

acerbus Boheman. Cuba.

Homocloeus *Jordan.*

vestitus Jordan. Antilles.

caliginosus Boheman. Cuba.

INDEX OF FAMILIES AND GENERA.

59,57,5(75.9)

Article XXXI.—INSECTS OF FLORIDA.

II. HEMIPTERA.

H. G. Barber, Roselle Park, N. J.

Mr. E. P. Van Duzee in his "Observations on Some Hemiptera taken in Florida, in the Spring of 1908," published in the Bulletin of the Buffalo Society of Natural Sciences, 1909, pp. 149–230, included mainly those species which he had collected during his four weeks' trip in that state. He refrained from incorporating the material in Mrs. Annie Trumbull Slosson's collection, for the determination of which he is so largely responsible. The reason for this was that he hoped she could be induced to publish independently a list of the species in her very fine collection which she has gathered as a result of her own efforts on her numerous trips to Florida. Mrs. Slosson, feeling rather disinclined to publish such a list and learning that the American Museum of Natural History proposed to make a much needed general survey of the insects of the state, very generously allowed me to make free use of her records of capture in the hemiptera. As will be observed the bases of this list are the records of Mr. Van Duzee and Mrs. Slosson's collection. I have been able to add numerous species, several of them new, from the study of material taken by Mr. William T. Davis who has made three trips to Florida and from the results of the two expeditions of the American Museum of Natural History. The hemiptera obtained by Mr. George P. Engelhardt in the fall of 1911, those collected by Mr. Charles E. Sleight in the early autumn of 1913 and the collection of the Florida Experiment Station, situated at Lake City, also passed through my hands for study. Professor C. W. Johnson of the Boston Society of Natural Sciences, kindly transmitted a list of hemiptera taken by him, chiefly at St. Augustine, a number of years ago and identified by Mr. P. R. Uhler. Likewise Mr. W. L. McAtee of the U. S. Biological Survey furnished me some valuable records. With the kindly coöperation of the authorities at the U. S. National Museum I was allowed to examine and make notes of the Florida material in the collection largely gathered by Schwarz, Hubbard and Ashmead. Mr. Otto Heidemann and Mr. Nathan Banks also kindly gave me some records from their collections. I have been able to supply a number of additional records by searching through the publications of the principle hemipterists, notably Uhler, Bergroth, Ball, Baker, Osborn and Kirkaldy. There are also included a number of hemiptera from my own

collection which have been generously presented to me by Professor E. B. Wilson of Columbia University and Mr. William Beutenmüller.

I am much indebted to Mr. E. P. Van Duzee who has taken considerable pains to go over my list of homoptera, correcting it and adding a number of records. In fact he is chiefly responsible for this group in my list, having determined all of the species in the collection of Mrs. Slosson and those in the collection of the American Museum of Natural History. Mr. William T. Davis, who is studying the Cicadidæ was of considerable assistance to me in this group.

This aims to be a complete list of the hemiptera of Florida with the exception of the Aphididæ, Psyllidæ, Coccidæ and allied families. It contains a total of 666 species and varieties, 372 heteroptera and 294 homoptera or 300 more than are found in Mr. Van Duzee's list of 1909. It may be of interest to note in comparison that Gillette and Baker's List of the Hemiptera of Colorado contained a total of 546 species and Smith's New Jersey List has 683 species and varieties of hemiptera.

In common with the remainder of the fauna of Florida there has been considerable speculation as to the sources of its hemipteron fauna. Being so situated, geographically, its fauna shows peculiar West Indian and Central American affinities intermixed with a much larger proportion of familiar species occurring more or less widely distributed in the United States. In order to throw some light on this subject I have given some study to the dispersal of the heteroptera in the Floridian fauna. I have confined my investigation to the heteroptera because, being more especially interested in it, I have collected data sufficient to draw certain deductions therefrom. The following diagram will best serve to graphically represent the source of each of the geographical groups, represented in the fauna, in their proper proportion.

An analysis of these figures shows that about $12\frac{1}{3}\%$ or 46 species are strictly Floridian, so far as the records are known; only 23 or a little over 6% are common to Florida and the West Indies and the greatest number, 141 or about 38% are restricted to Florida and the United States. The remaining 162 species are largely contributed from Central America either by way of the United States or by the West Indies. It is a well recognized fact that the vast majority of our hemiptera have spread northwardly from Mexico, extending as far as the conditions of environment would suit them, in the United States. It is comparatively easy to trace one line of this dispersal by way of the gulf strip into Florida. The West Indian contingent in the Floridian fauna can be accounted for only by accidental introduction mainly through the various channels of commerce. I am much inclined to doubt the possibility of hemiptera surviving the long submergence necessary for the water transit over the intervening distance. Wind currents

can have been responsible for the possible introduction of a few of the larger, stronger fliers among the hemiptera, especially when this wind attains the violence of a West Indian hurricane and provided, of course, that the wind is in the right direction.

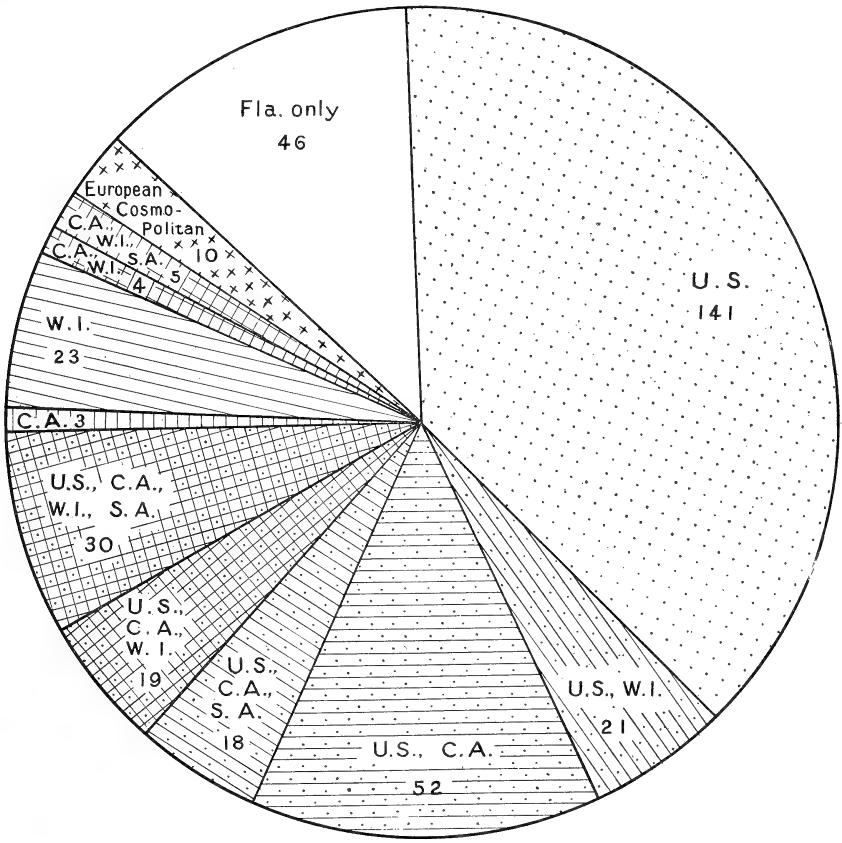


Fig. 1. The area of the circle represents the number of species of Heteroptera recorded from Florida. Each segment is approximately proportional to the number of species in the respective geographic group. The figures give the actual number of species. By "U. S." should be understood the United States exclusive of Florida.

Sub Order HETEROPTERA.

Corixidæ.

Callicorixa kollarii Fieb. "Florida" (Kirkaldy and Bueno Cat.).

Arctocorisa (*Corixa*) *abdominalis* Say. "Florida" (Bank's Cat.).

Arctocorisa (*Corixa*) *reticulata* Guér. Charlotte Harbor and Biscayne Bay (Mrs. Slosson); Punta Gorda, Nov., Ft. Myers Nov., Titusville, Nov. (A. M. N. H.).

Ochteridæ.

Ochterus americanus Uhl. Lake Worth, Belleair, Biscayne Bay, (Mrs. Slosson).
Ochterus flaviclavus Barb. Ormond (Mrs. Slosson).

Nerthridæ.

Gelastocoris oculatus Fab. Crescent City, Apr., St. Petersburg, Apr., Ft. Myers, May (Van Duzee); Biscayne Bay (Mrs. Slosson); St. Augustine (Johnson); Lake Okechobee, Apr., Ft. Myers, Nov. (A. M. N, H.); Sanford, Lake City (Fla. Exp. Sta.); Jacksonville, Miami, Tampa, Feb. (U. S. N. M.); La Grange, Nov., Deep Lake, Apr., Everglade, Apr., Lake Okechobee, Apr. (Davis).

Nerthra stygica Say. Charlotte Harbor (Mrs. Slosson); Ft. Myers, Nov. (A. M. N. H.); Enterprise (My coll. from Wm. Beutenmüller).

Belostomatidæ.

Benacus griseus Say. Clearwater, Apr. (Van Duzee); Ft. Myers, Nov. (A. M. N. H.); Ft. Myers, Apr. (Davis); Daytona, Nov. (Engelhardt); St. Augustine (Johnston); "Florida" (Kirkaldy and Bueno Cat.); "Florida" (Uhler).

Lethocerus (*Belostoma*) *americanus* Leidy. Jacksonville (Mrs. Slosson); "Florida" (Uhler).

Lethocerus (*Belostoma*) *uhleri* Mont. Clearwater, Apr., (Van Duzee); Ft. Myers, Apr., Nov. (A. M. N. H.); Lake City (Fla. Exp. Sta.); Daytona Nov. (Engelhardt); Lake Worth (Mrs. Slosson); Ft. Myers, Apr., Ortega, Sept. (Davis); Ortega Sept. (Sleight).

Belostoma (*Zaitha*) *boscii* Lep. et Serv. "Florida" (Uhler).

Belostoma (*Zàitha*) *aurantiacum* Leidy. Biscayne Bay (Mrs. Slosson); Titusville, Nov. (A. M. N. H.); Everglade, June (Davis); "Florida" (Kirkaldy and Bueno Cat.).

Belostoma (*Zaitha*) *flumineum* Say. Biscayne Bay (Mrs. Slosson); St. Augustine (Johnson); Everglade, June (Davis).

Belostoma testaceum Leidy. Titusville, Nov. (A. M. N. H.).

Nepidæ.

Ranatra americana Mont. Titusville, Nov. (A. M. N. H.); St. Augustine, Nov. (Engelhardt).

Ranatra fusca Beauv. "Florida" (U. S. N. M.); Kissimmee, (U. S. N. M.); "Florida" (Kirkaldy and Bueno Cat.).

Ranatra protensa Mont. "Florida" (U. S. N. M.).

Naucoridæ.

Pelocoris carolinensis Bueno. St. Augustine, Nov. (Engelhardt); Titusville, Oct. (A. M. N. H.); Lake City (Fla. Exp. Sta.); "Florida" (Kirkaldy and Bueno Cat.).

Pelocoris femoratus Pal. Beauv. Biscayne Bay, Belleair (Mrs. Slosson); St. Augustine, Nov. (Engelhardt); St. Augustine (Johnson); "Florida" (Uhler); "Florida" (Kirkaldy and Bueno Cat.).

NOTONECTIDÆ.

Notonecta irrorata Uhl. St. Augustine (Johnson).

Notonecta uhleri Kirk. "Florida" (Kirkaldy and Bueno Cat.).

Notonecta undulata Say. Lakeland, Nov. (Davis); St. Augustine (Engelhardt); Lake City (Fla. Exp. Sta.).

Notonecta variabilis Fieb. "Florida" (Johnson).

Buenoa carinatus Champ. Lakeland, Nov. (Davis).

Buenoa margaritacea Bueno. Titusville (A. M. N. H.).

Plea striola Fieb. "Florida" (Uhler).

ACANTHIADÆ.

Acanthia humilis Say. Jacksonville (Mrs. Slosson); Northern Florida (Uhler); Florida (K. and B. Cat.).

Acanthia interstitialis Say. Biscayne Bay, Ormond (Mrs. Slosson); "Florida" (Uhler).

Acanthia pallipes Fab. Biscayne Bay (Mrs. Slosson); Lakeland, May (Davis); Everglade, Apr.; Ft. Myers, Mch. (A. M. N. H.).

Acanthia signoretti Guér. Biscayne Bay (Mrs. Slosson); Marco, Apr., Punta Gorda, Nov. (A. M. N. H. and Davis); Key West, Sept. (Davis); Pablo Beach, Sept., (Sleight); St. Augustine (Johnson).

Acanthia sphacelata Uhl. Biscayne Bay (Mrs. Slosson); Marco, Apr. (A. M. N. H.); Marco, Apr., Ft. Myers, Mch. (Davis).

Acanthia xanthochila var. *limbosa* Horv. Biscayne Bay (Mrs. Slosson); Everglade, Apr., May, Ft. Myers, Mch., Marco, Apr. (Davis); Everglade, Apr., Ft. Myers, Mch., Marco, Apr., Lakeland, May, Lake Okechobee, May (A. M. N. H.).

Saldoida cornuta Osb. Punta Gorda, Belleair (Mrs. Slosson).

Saldoida slossoni Osb. Punta Gorda, Belleair (Mrs. Slosson).

GERRIDÆ.

Gerris canaliculatus Say. Titusville (A. M. N. H.); St. Augustine (Johnson); Daytona, Nov. (Engelhardt).

Limnogonus hesione Kirkaldy. Daytona, Nov. (Engelhardt); "Florida" (K. and B. Catalogue).

Halobates micans Esch. Lake Worth (Mrs. Slosson); Ocean Beach at Miami, Sept. (Davis); Florida Coast (K. and B. Cat.).

VELIADÆ.

Velia brachialis Stål. Pemberton (Johnson).

Rhagovelia plumbea Uhl. Indian River (U. S. N. M.); Marco, Apr. (Davis); Ten Thousand Islands (A. M. N. H.); Florida (K. and B. Cat.); "A common species on the surface of salt water around the inlets of the Florida Keys" (Uhler).

Rhagovelia collaris Burm. "Florida" (Uhler).

Microvelia marginata Uhl. "From Florida to northern New Jersey" (Uhler); "New Jersey to Florida" (K. and B. Cat.).

HYDROMETRIDÆ.

Hydrometra australis Say. Jacksonville (Mrs. Slosson); Florida (K. and B. Cat.).

Hydrometra martini Kirk. Titusville, Nov. (A. M. N. H.); "Florida" (K. and B. Cat.).

MIRIDÆ OR CAPSIDÆ.

Apocremnus (Psallus) sulphureus Reut. Sevenoaks, Tampa, Estero (Van Duzee).

Apocremnus (Psallus) juniperi Heid. Crescent City, (U. S. N. M.).

Apocremnus (Psallus) guttulosus Reut. Belleaire, Jacksonville (Mrs. Slosson).

Atomoscelis seriatus Reut. Sevenoaks, Tampa (Van Duzee); Atlantic Beach (Mrs. Slosson).

Cylloceps pellicia Uhl. Biscayne Bay (Mrs. Slosson).

Europiella rubidus Uhl. Belleair (Mrs. Slosson).

Leucopoecila ablofasciata Reut. Belleair (Mrs. Slosson).

Plagiognathus politus Uhl. Biscayne Bay (Mrs. Slosson).

Reuteroscopus ornatus Reut. Sanford, Crescent City (Van Duzee); East Florida (U. S. N. M.).

Rhinocloa forticornis Reut. Lake Worth, Biscayne Bay (Mrs. Slosson).

Halticus citri Ashm. Crescent City, Sanford (Van Duzee); Biscayne Bay (Mrs. Slosson).

Lomatopleura hesperus Kirk. St. John's Bluff, East Florida (Walker's Cat.); "Florida" (Banks' Cat.).

Ceratocapsus pumilus Uhl. Crescent City, Sanford (Van Duzee).

Ceratocapsus setosus Reut. Lakeworth, Atlantic Beach (Mrs. Slosson).

Pseudoxenetus regalis Uhl. Belleair, Jacksonville (Mrs. Slosson).

Coquillettia mimetica Osborn. Crescent City, Jacksonville (Mrs. Slosson); Sanford (A. M. N. H.).

Engytatus (Cyrtopeltis) varians Dist. Biscayne Bay (Mrs. Slosson).

Macrolophus separatus Uhl. Ft. Myers (Van Duzee).

Cyrtocapsus caligineus Stål. Crescent City (Van Duzee).

Monalocoris filicis Linn. Sanford (Van Duzee).

Pycnoderes 4-maculatus Guer. Biscayne Bay (Mrs. Slosson).

Sixeonotus insignis Reut. Crescent City, Sanford, Sevenoaks, Ft. Myers (Van Duzee); Archer (U. S. N. M.); Everglade, Apr., Lake Okechobee, May (Davis).

Sixeonotus tenebrosus Dist. Clearwater (Van Duzee); Belleair (Mrs. Slosson); La Belle, Apr. (Davis).

Fulvius atratus Dist. Biscayne Bay (Mrs. Slosson).

Collaria explicata Uhl. Biscayne Bay (Mrs. Slosson).

Collaria oculata Reut. Crescent City, Sevenoaks (Van Duzee); Belleair, Jacksonville (Mrs. Slosson); Miami, Sept., Lakeland, May (Davis).

Trigonotylus pulcher Reut. Crescent City, Sanford, Ft. Myers, St. Petersburg (Van Duzee); Lakeworth, Biscayne Bay, Belleair, Ormond (Mrs. Slosson); Everglade Apr. (Davis).

Lopidea floridanus Walk. "Florida" (Banks' Cat.).

Resthenia incisus Walk. "Florida" (Banks' Cat.).

Resthenia insignis Say. "Widely distributed in Florida" (Van Duzee); Florida U. S. N. M.).

Resthenia insitiva Say. Crescent City (Van Duzee); Sanford (A. M. N. H.); Biscayne Bay (Mrs. Slosson).

Resthenia intercidenda Dist. Biscayne Bay (Mrs. Slosson); Ft. Myers, Apr. (Davis).

Resthenia rubrovittata Stål. Sanford (A. M. N. H.).

Creontiades filicorne Walk. "Florida" (Banks' Cat.).

Creontiades rubrinervis Stål. "Not uncommon at all localities" (Van Duzee); La Grange, Sept. (Davis); Jacksonville, Sanford, Lakeland, Crescent City (A. M. N. H.).

Dichrooscytus maculatus Van Duz. Sevenoaks (Van Duzee).

Eustictus grossus Uhl. Crescent City (Van Duzee); Biscayne Bay (Mrs. Slosson); "Florida" (Uhler).

Eustictus mundus Uhl. Crescent City (Van Duzee); "Florida" (Uhler).

Eustictus venatorius Van Duzee. Key West, Sept. (Sleight); Crescent City (Van Duzee); Lakeland, May (Davis).

Garganus fusiformis Say. Crescent City (Van Duzee); Jacksonville (Mrs. Slosson); Crescent City (A. M. N. H.).

Lygus apicalis Fieb. Sanford, Tampa, Sevenoaks, Ft. Myers (Van Duzee); Belleair, Biscayne Bay (Mrs. Slosson); Punta Gorda, Lakeland, Sanford, Newberry (A. M. N. H.).

Lygus olivaceus Reut. "Abundant everywhere in Florida" (Van Duzee); Crescent City, Clearwater, Sanford (A. M. N. H).

Lygus pratensis Linn. Jacksonville, Clearwater (A. M. N. H.).

Lygus tenellus Van Duz. Sevenoaks, Crescent City (Van Duzee); Ft. Myers, Apr. (Davis).

Neurocolpus nubilus Say. Sevenoaks (Van Duzee).

Phytocoris bipunctatus Van Duzee. "Common on the dry sparse grasses in the pine barrens everywhere south of Sanford" (Van Duzee); "East Florida" (U. S. N. M.); Ft. Myers, Apr., La Grange, Sept. (Davis).

Phytocoris eximius Reut. Crescent City, Sevenoaks (Van Duzee); Jacksonville (A. M. N. H.).

Phytocoris rufus Van Duz. Sevenoaks (Van Duzee).

Poecilocapsus lineatus Fab. Jacksonville, Atlantic Beach (Mrs. Slosson); Lakeland, May (Davis).

Poecilocapsus nigriger Stål. "Not uncommon at all localities" (Van Duzee).

Poeciloscytus americanus Reut. Sanford (Van Duzee).

Poeciloscytus basalis Reut. "Abundant everywhere I collected in Florida" (Van Duzee); Jacksonville, Newberry, Sanford (A. M. N. H.).

Poeciloscytus cuneatus Dist. Biscayne Bay (Mrs Slosson); Ft. Myers, Apr. (Davis).

Poeciloscytus obscurus Uhl. "Southern Florida" (Banks' Cat.).

Tropidosteptes cardinalis Uhl. Jacksonville (Mrs. Slosson).

Anthocoridæ.

Lasiochilus pallidulus Reut. Lake Worth, Biscayne Bay (Mrs. Slosson): Silver Springs, Nov. (Engelhardt); Everglade (A. M. N. H. and Davis).

Piezostethus galactinus Fieb. Biscayne Bay (Mrs. Slosson).

Triphleps insidiosus Say. Biscayne Bay, Jacksonville (Mrs. Slosson); Lakeland, Nov., Punta Gorda, Nov. (A. M. N. H.).

Triphleps tristicolor B. White. Lake Worth (Mrs. Slosson).

Cardiastethus assimilis Reut. Lakeland, Nov., Marco, Apr., (Davis).

Cimicïdæ.

Cimex lectularius Linn. "Florida" (Schwartz).

Nabidæ.

Reduviolus capsiformis Germ. Biscayne Bay, Belleair (Mrs. Slosson). Tampa, Everglade, Apr., Miami, Nov., Lakeland, Nov., Titusville, Nov. (A. M. N. H.); Ft. Myers, Apr., (Davis).

Reduviolus sordidus Reut. Newberry, Apr., (A. M. N. H.).

Pagasa pallipes Stal. Newberry, Nov., Jacksonville (A. M. N. H.); Jacksonville (Mrs. Slosson); Key Largo, Dec., (U. S. N. M.).

Metatropiphorus belfragii Reut. Clearwater, Apr. (A. M. N. H.).

Næogeidæ.

Nœogeus concinnus Uhl. Biscayne Bay (Mrs. Slosson).

Nœogeus consolidus Uhl. Lake Worth (Mrs. Slosson).

Mesoveliadæ.

Mesovelia mulsanti B. White. Lake Worth, Belleair (Mrs. Slosson); Titusville, Nov., Punta Gorda, Nov., Jacksonville, Nov. (A. M. N. H.); "Florida" (K. and B. Cat.).

Reduviidæ.

Barce fraterna Say. Lake Worth (Mrs. Slosson).

Emesa longipes De Geer. Crescent City, Apr. (Van Duzee) La Belle, Apr., Jacksonville, Nov. (A. M. N. H.); Lakeland, Nov., Jacksonville, Nov., La Belle, Apr., Ortega, Sept., (Davis); Silver Springs, Nov. (Engelhardt).

Ploiariodes errabunda Say. Crescent City, Apr., Sanford, Apr., Tampa, May, Ft. Myers, May (Van Duzee).

Ploiaria carolina H. Schf. Pablo Beach (Sleight).

Stenolaemus spiniventris Sign. Miami, Sept. (Davis). A single specimen which agrees with the description of Signoret, except in having a single spine on the scutellum which is shorter than in Signoret's illustration and directed obliquely to the rear; and the ventral spines are reduced. The fine silky hairs on the antennæ and legs are much longer than figured. Uhler has reported this species from Arizona and Cuba. It was described from Mexico.

Ghilianella productilis sp. nov.

Sordid fulvo-testaceous, with antennæ, second and third pairs of legs paler, not annulate with fuscous. Head granulated on the sides and with the thorax and abdomen provided with fine pale pubescence. Head long, cylindrical with the sides

parallel, converging more sharply on the basal third, infuscated on the sides; eyes small; the division behind the transverse stricture slightly longer than the anterior one; the pale frontal spine very slightly decurved, almost horizontal. The antennæ are pale with the base of the first joint and the last two darker; these last two segments closely set with fine whitish hairs, with the basal fourth of the last, smooth and hairless; first joint of antennæ reaching about midway on the metanotum. Prothorax scarcely granulose, obscurely infuscated on the sides, slightly longer than the mesothorax and the metathorax, while these two latter are subequal in length; meso- and metathorax are dorsally fattened and furnished with three carinae, a median one and one limiting the margin on each side; the posterior margin of the metanotum widely cut out behind. Basal half of the anterior coxæ pale, apical half and femora darker becoming infuscated beneath and provided with fine, pale incumbent hairs; fore tibiæ pale except at apex; coxæ about one third longer than pronotum; fore femoræ about as long as pro- and mesothorax together; tibiæ and tarsi about subequal in length, these latter slightly curved and faintly serrated within; the spines of femoræ pale, black tipped. Second and third pairs of legs pale, with apex of tibiæ and tarsi fuscous. Abdomen a little longer than head and thorax together and linear in both sexes, but in the female this part gradually widens posteriorly from a narrow basal portion; darker both above and below than the thorax; longitudinally sharply depressed next each side leaving a median convex ridge and sharply elevated margins; dorsally, the incisures are transversely straight and the posterior apical angles are not produced, except in the sixth segment in the female; a minute black tubercle is placed in the middle just before the posterior margin of the first five segments; the spiracles are tuberculately elevated just beneath the impressed lateral edge and visible from above. Beneath, the abdomen is somewhat mottled with fuscous, provided with fine, pale appressed hairs; slightly carinate in the middle, more obviously so, posteriorly; the incisures curved. In the male, the last dorsal segment of the abdomen ends in an acute, rugulose, flattened process or flap which curves upward and extends well beyond the genital segment; this process is infuscated, pale and smoother on the edges and somewhat carinate in the center; the ventral genital plate somewhat compressed, subcarinate. In the female, the genital segment appears truncate, with the apical angles of the sixth segment produced in short spines; the median dorsal convex ridge becoming more carinate on the sixth segment and ending in a small black tooth posteriorly; the first genital segment obtusely triangular, transversely rugulose and keeled; the second genital segment also keeled, rugulose and narrowly rounded at apex. ♂ 23 mm. and ♀ 25 mm. long.

The male specimen, from Big Pine Key, has the dorsal prolonged upturned flap of the last abdominal segment, pale and differently shaped than in the type male specimen described from Marco. This part is almost quadrate gradually rounded behind and with a minute blackish tubercle at each posterior angle.

I have not seen specimens of *G. angulata* described by Uhler from the West Indies, but judging from the description, this new species is more closely related to that species, from which it can be separated by the subequal length of the meso- and metathorax, the non toothed outer angles of the abdominal segments with the exception of the sixth, and the non-annulate antennæ and legs. The type male is in the collection of Mr. William T. Davis of Staten Island and the type female in the collection of the American Museum of Natural History.

Saica Am. et Serv.

The members of this genus are slender. The ocelli are absent; the anterior tibiæ are curved and unarmed; the pronotum and scutellum are armed with long spines; the intermediate and hind legs are long and slender and the anterior femora are provided with setæ, which sometimes adhere and appear to be spines. Five species are characterized by Champion from Mexico and Central America, Amyot and Serville have described *S. rubella* from Guiana and Dr. Bergroth, *S. cruenta* from French Guiana.

Saica fusco-vittata sp. nov.

Body elongate, narrow. Smooth, shining stramineous in color, dorsally with a broad ill-defined fuscous stripe, beginning on the vertex of the head and running through to the tip of the membrane; on the sides is another poorly defined fuscous stripe beginning back of the eyes and continued along the sides of the sternum, sometimes extended along the sides of the venter to the apex. The femoræ with apreapical and the tibiæ with a prebasal and apical fuscous band, with close set fine hairs underneath on the venter and on antennæ and tibiæ, more scattering on the sternum and femoræ. Head is stramineous, infuscated, swollen behind the eyes. Rostrum stramineous, sometimes apically infuscated, its apex ending between the two anteriorly projecting acute (not spinose) prosternal processes; second joint swollen at base. Antennæ long, slender, dirty stramineous, with apex of second joint which is about one third the length of first, and the remainder infuscated; first two joints with rather close set fine hairs, the last two with finer, appressed hairs. Pronotum smooth, shining and glabrous, the anterior lobe slightly longer than the posterior, and longitudinally deeply sulcate in the middle, with two tuberosities at each anterior angle and one on each side margin before the transverse furrow which are not so prominent; humeri elevated in a longitudinal elongate tuberosity; the anterior part of each is armed with an elongate, straight, acute, outwardly directed spine, infuscated at tip. Sternum smooth, with a few fine scattered hairs; the prosternal processes diverging, acute. The fore femoræ are pale with a preapical and the fore tibiæ with preapical and apical fuscous band; the trochanters are armed with a single short blunt spine; these legs are provided with close set fine hairs and the femoræ beneath and the tibiæ within have close set longer and stouter setose hairs; the middle femoræ have a conspicuous preapical and a faint median fuscous band; the hind femoræ have a faint apical and median and a more conspicuous preapical band; the middle and hind tibiæ have a prebasal band and apex fuscous; tarsi pale. Scutellum black, elevated at base into a black strong tubercle surmounted at apex with a long pale backwardly inclined slightly curved spine as long as the pronotal spines; at apex of the scutellum is a short, acute less inclined black spine; midway between these two scutellar spines is a very short black blunt tubercle. Corium smooth, duller than the pronotum, glabrous through the center broadly infuscated, some of the stronger nervures faintly rosaceous, the few nervures of the infuscated membrane pale. Venter smooth, shining, finely pubescent, along the sides sometimes with a fuscous stripe; the genital segment of the female infuscated.

Length 8 mm. Described from a male in the collection of the American Museum

of Natural History and a female in the collection of Mr. William T. Davis. Both from Everglade, Florida; April, 1912. This species seems to be most closely related to *Saica erubescens* Champ.

Oncerotrachelus acuminatus Say. Charlotte Harbor, Ormond (Mrs. Slosson); St. Augustine (Johnson).

Pnirontis infirma Stål. La Belle, Apr., Everglade, Apr., Ft. Myers, Mch. (A. M. N. H.); Ft. Myers, Mch. (Davis).

Pnirontis languida Stål. Ft. Myers (A. M. N. H.); St. Augustine (Johnson); "Florida" (Uhler).

Pnirontis modesta Banks. Titusville, Nov. (A. M. N. H.).

Pygolampis pectoralis Say. Ft. Myers, Nov.; Jacksonville, Belleair, Biscayne Bay (Mrs. Slosson); St. Augustine (Johnson); Ft. Myers, Apr., Lakeland, May, Everglade, July (Davis); Baldwin (U. S. N. M.); Florida (Uhler).

Stenopoda culiciformis Fabr. "Florida" (Uhler); Ft. Myers (Van Duzee); St. Augustine (Johnson); Punta Gorda, Apr., Marco, Apr., South Jacksonville, Sept., Miami, Sept. (Davis).

Oncocephalus geniculatus Stål. Everglade, Apr. (A. M. N. H.); Florida (Brooklyn Museum).

Narvesus carolinensis Stål. Lake City (Exp. Stat. Florida).

Reduvius personatus Linn. Belleair, Jacksonville (Mrs. Slosson).

Conorhinus sanguisugus Le Conte. Sevenoaks, May (Thurston); Estero, May (Van Duzee); Jacksonville, Nov. (A. M. N. H.); Lake City (Florida Exp. Sta.); Biscayne Bay, Belleair, Jacksonville (Mrs. Slosson); Fernandino (U. S. N. M.); St. Augustine (Johnson); "Florida" (Uhler); Chokoloskee (my coll.).

Melanolestes picipes H. Schf. Jacksonville (Davis); Silver Springs (Englehardt).

Rasahus biguttatus Stål. Ormond, Biscayne Bay, Belleair; Charlotte Harbor (Mrs. Slosson); St. Augustine (Johnson); Ft. Myers, Mch. (A. M. N. H.); Everglade, Apr. (Davis); Cedar Keys, June (McAtee).

Rasahus hamatus Fabr. Punta Gorda, Nov. (A. M. N. H.); Ft. Myers, Apr., Everglade, July (Davis); Silver Springs, Nov. (Engelhardt).

Sirthenea stria Fab. Clearwater, Apr., (Van Duzee) Enterprise (U. S. N. M. and my collection).

Ectrichodia cruciata Say. Crescent City, Apr. (Van Duzee) Atlantic Beach (Mrs. Slosson); Palm Beach, Nov. (Engelhardt); Everglade, June (Davis); St. Augustine (Johnson); Georgiana (U. S. N. M.).

Hammatocerus purcis Drury. Ormond, Tarpon Springs (Mrs. Slosson); Silver Springs, Nov. (Engelhardt); St. Augustine (Johnson); Jacksonville, Enterprise (My collection).

Apiomerus crassipes Fabr. Crescent City, Apr., St. Petersburg, Apr., Clearwater, Apr., Tampa, May, Estero, May (Van Duzee); Charlotte Harbor, Ormond, Biscayne Bay, Jacksonville, Lake Worth (Mrs. Slosson); St. Augustine (Johnson); Jacksonville, Sept., Ortega, Sept. (Davis); Enterprise (My collection).

Apiomerus spissipes Fab. Ft. Myers, Mch. (A. M. N. H.); Lakeland, May, Ft. Myers, Apr., Miami, Sept., La Grange, Sept., Big Pine Key, Sept. (Davis); Georgiana, Marathon, Dec. (U. S. N. M.); Elliott's Key, Enterprise (My collection).

Zelus bilobus Say. Crescent City, Apr., Sanford, Apr., Estero, May (Van Duzee); Charlotte Harbor, Ormond (Mrs. Slosson); Key Largo, Nov., Ft. Myers, Nov., Miami, Nov., Punta Gorda, Nov., Newberry, Nov. (A. M. N. H.); Lake City (Florida Exp. Sta.); Silver Spring, Nov., Daytona, Nov., St. Augustine, Nov., Key

West, Nov. (Engelhardt); Punta Gorda, Nov., Lakeland, May, Nov., Newberry, Nov., Ft. Myers, Apr., Marco, Apr., Everglade, Apr., Big Pine Key, Sept., Miami, Sept., Pablo Beach, Sept., Key West, Sept., La Grange, Sept., So. Jacksonville, Sept. (Davis); Biscayne Bay, Kissimmee (Banks); St. Augustine (Johnson); Marathon, Little River, Archer, Rock Ledge (U. S. N. M.).

Zelus cervicalis Stål. "Abundant everywhere I collected in Florida" (Van Duzee); Biscayne Bay, Jacksonville, Ormond (Mrs. Slosson); Punta Gorda, Nov., Lakeland, May, Nov., Newberry, Nov., Ft. Myers, Apr., Ortega, Sept., So. Jacksonville, Sept., La Grange, Sept., Pablo Beach, Sept. (Davis); Sanford, Apr., Lakeland, May, Nov., Ft. Myers, Apr., Nov., La Belle, Apr. (A. M. N. H.); St. Augustine (Johnson).

Zelus socius Uhl. Crescent City, Apr. (Van Duzee); Allen River to Deep Lake, Apr. (Davis).

Zelus luridus Stål. "Florida" (Uhler).

Pselliopus cinctus Fab. Crescent City, Apr. (Van Duzee); Jacksonville (Mrs. Slosson).

Repipta taurus Fab. Crescent City, Apr., Sanford, Apr., Clearwater, Apr. (Van Duzee); Jacksonville, Atlantic Beach, Lake Worth, Charlotte Harbor (Mrs. Slosson); Sanford, Apr., Lakeland, May (A. M. N. H.); St. Augustine (Johnson); Kissimmee (Banks); "Florida" (Uhler).

Fitchia spinosula Stål. Newberry, Nov. (A. M. N. H. and Davis).

Atrachelus cinereus Fab. "Not uncommon at most places where I collected" (Van Duzee); Punta Gorda, Nov. (A. M. N. H. and Davis); Lakeland, Nov. (Davis); Belleair, Ormond (Mrs. Slosson); St. Augustine (Johnson); Kissimmee (Banks).

Doldina praetermissa Bergroth. Charlotte Harbor (Mrs. Slosson); Ft. Myers, Apr., Everglade, Apr. (Davis); St. Augustine (Johnson); Georgiana (U. S. N. M.).

Arilus cristatus Linn. Crescent City, Apr. (Van Duzee); Jacksonville, Nov., Ft. Myers, Apr. (A. M. N. H.); Biscayne Bay (Mrs. Slosson); Lake City (Florida Exp. Sta.); Lakeland, May (Davis); St. Augustine (Johnson).

Sinea diadema Fab. Biscayne Bay (Mrs. Slosson); "Florida" (Uhler).

Sinea rileyi Mont. "Taken at nearly all stations where I collected in Florida" (Van Duzee); Charlotte Harbor (Mrs. Slosson).

Sinea spinipes H. Schf. Key Largo, St. Petersburg, Apr. (Van Duzee); Sanford, Apr., Newberry, Nov., Lakeland, May, Nov., Ft. Myers, Apr., Miami, Nov., Punta Gorda, Nov., Titusville, Nov. (A. M. N. H.); Silver Springs, Nov., St. Augustine, Nov., (Engelhardt); Jacksonville, Nov., Lakeland, Apr., Nov., Ft. Myers, Apr. Marco, Apr., Punta Gorda, Nov. (Davis); Little River, Miami (U. S. N. M.).

Macrocephalidæ or Phymatidæ.

Phymata erosa Linn., var. *guerini* Leth. and Sev. Ft. Myers, May, Estero, May, Crescent City, Apr., Key Largo (Van Duzee); Punta Gorda, Nov., Lakeland, May, Nov., Ft. Myers, Apr., Marco, Apr., Big Pine Key, Sept., La Grange, Sept., So. Jacksonville, Sept. (Davis); Lake Worth, Biscayne Bay (Mrs. Slosson); St. Petersburg, Sanford, Newberry, Nov., Ft. Myers, Apr., Nov., Key Largo, Nov., Punta Gorda, Nov., Lakeland, May, Nov., Jacksonville, Nov., Titusville, Nov., La Belle, Nov., Marco, Apr. (A. M. N. H.); Lake City (Florida Exp. Sta.); Little River, Fernandino, Archer (U. S. N. M.); Daytona, Nov., Miami, Nov., Silver Springs Nov. (Engelhardt).

Phymata erosa Linn., var. *fasciata* Gray. "Florida" (Handlirsch 1897).

Phymata erosa Linn., var. *pensylvanica* Handl. "Florida" (Handlirsch 1897).

Phymata noualhieri Handl. Biscayne Bay (U. S. N. M.).

Phymata vicina Handl. Sanford, Apr. (Van Duzee); "Florida" (Handlirsch 1897).

Macrocephalus cimicoides Swed. Tampa, May (Van Duzee); Ft. Myers, Nov., Jacksonville, Nov. (A. M. N. H.); Charlotte Harbor, Biscayne Bay (Mrs. Slosson); Archer (U. S. N. M.); "Florida" (Handlirsch 1897).

Macrocephalus prehensilis Fab. Sanford, Apr., St. Petersburg, Apr. (Van Duzee); Jacksonville (Mrs. Slosson); Crescent City, St. Petersburg (A. M. N. H.); St. Augustine (Johnson); St. Nicholas, Archer, Capron (U. S. N. M.); Runnymede (Banks).

Henicocephalidæ.

Henicocephalus biceps Say (= *culicis* Uhl.). "Florida" (Uhler).

Piesmidæ.

Piesma cinerea Say. Lake Worth (Mrs. Slosson).

Tingididæ.

Corythuca floridana Heid. Crescent City, Apr. (Van Duzee); Ormond, Biscayne Bay (Mrs. Slosson); Bartow, June (Heidemann).

Corythuca gossypi Fab. Biscayne Bay (Mrs. Slosson); Miami, Key West (U. S. N. M.).

Corythuca marmorata Uhler. Ft. Myers, May (Van Duzee); Lake Worth (Mrs. Slosson).

Telconemia belfragei Stål. Crescent City, Apr. (Van Duzee); Biscayne Bay (Mrs. Slosson); Lakeland, May (Davis).

Teleonemia sacchari Fab. Biscayne Bay (Mrs. Slosson); Key West (U. S. N. M.).

Teleonemia scrupulosa Stål. Key West (U. S. N. M.).

Atheas austroriparius Heid. Duval Co. (Heidemann).

Atheas exiguus Heid. Sevenoaks, Apr. (Van Duzee). "Florida" (Uhler).

Leptoypha mutica Say. Jacksonville (Mrs. Slosson).

Acanthochila exquisita Uhl. Biscayne Bay (Mrs. Slosson); Key West (U. S. N. M.).

Acysta perseæ Heid. Eustis, July, Ft. Myers, July, Cutler, Aug., Baldwin, Mch., Orlando, Miami, Feb., St. George, Apr. "On Alligator pears and camphor trees" (Heidemann).

Pyrrhocoridæ.

Largus davisi sp. nov.

Head, antennæ, rostrum, anterior lobe of pronotum in the center, apical half of femoræ, tibiæ and tarsi, and for the most part the scutellum and venter, black. Anterior margin of the pronotum, narrowly, the lateral margin and posterior lobe of pronotum, apex of scutellum, hemelytra, bucculæ faintly, margins of the acetabulæ, ostiolum, posterior margin of metathorax obscurely, trochanter and basal half

of all femoræ, narrow margin of abdomen, genital segment of the males posteriorly, yellowish-red. Greyish-sericeous especially on the head, anterior lobe of pronotum and beneath. Head black densely sericeous, bucculæ sometimes pale reddish. Antennæ more slender than in *L. succinctus*, black throughout, second joint a little more than twice as long as third, third joint about one third as long as the fourth, second and third joint subequal to the first joint, none of the joints as prominently hairy as *L. succinctus*. Pronotum a trifle wider than long; the anterior lobe subequal in length to the posterior lobe but not plainly demarked from it; seen from the side, the pronotum is gradually rounded, declivous, from the posterior margin forward; the anterior lobe somewhat more depressed than usual; the anterior margin depressed, with a few large, black, submarginal punctures; the yellowish-red posterior lobe furnished with fine, scattered, black punctures. Legs with the trochanters and basal half of all femoræ reddish-yellow; the second and third femoræ unarmed, the fore femoræ armed beneath, preapically, by a prominent acute, forwardly inclined spine, before which and situated closer to it and the apex is a one-half shorter spine, similarly inclined and tipped with a short seta. Hemelytra yellowish-red with rather evenly placed, fine, black punctures all over except on the lateral margins which are flattened and very little expanded, the basal third, obsoletely concave. The membrane not quite reaching the apex of the abdomen, brownish-yellow, paler at the basal inner angles, nervures concolorous, branching much as in *L. succinctus*. Venter black with narrow lateral margins and genital segment of male posteriorly, yellowish-red. Seen from below the abdomen is more compressed posteriorly than in *L. succinctus*.

Length ♂♂ 10–11 mm. Pronotum 2.75 mm. long and 3 mm. wide; width of hemelytra 4.5 mm.; length of corium 5.5 mm. Length of ♀♀ 12–13 mm.

Described from ♂ St. Augustine, Nov. 8, 1911, collected by Mr. G. P. Engelhardt; ♀ Indian River District, July, 1896, collected by Mr. William Beutenmuller (Both of these in my collection as types); two ♂♂ and one ♀ from Miami, Sept. 24, 1913, collected by Mr. Charles E. Sleight; three ♂♂ and two ♀♀ from Miami, Sept. 24, 1913, two ♂♂ Big Pine Key, Sept. 20, 1913 collected by Mr. William T. Davis for whom this species is named.

This species comes in the cinctus, succinctus, convivus, longulus group as arranged by Stål in the Enum. Hem. I, pp. 93–94, 1870. It is most closely related to *L. succinctus* Linn. from which it can be distinguished by the different coloring, the relatively shorter pronotum with the subequal lobes and as seen from the sides, the anterior lobe of *succinctus* is more elevated and abruptly rounded declivous before, while in *davisi* the whole pronotum is gradually rounded from the posterior margin. The relative thickness and length of the antennal joints is also different in the two species. The punctures on the posterior lobe of pronotum and hemelytra are more sparse and finer than in *succinctus*. From *longulus* Stål it differs in being relatively shorter and differently colored. The anterior lobe of *cinctus* is much more elevated than in *davisi*. The specimens of *succinctus* which I have used for comparison came from New Jersey and Virginia but I have also seen specimens of this species from Florida.

Largus succinctus Linn. Sanford, Apr., Sevenoaks, Apr., Estero, May (Van Duzee); Lake City (Florida Exp. Sta.); Charlotte Harbor, Jacksonville (Mrs. Slosson); Ft. Myers IV (Davis); Miami, Tallahassee (U. S. N. M.); Ft. Myers, Nov., Lakeland, Nov., Newberry, Nov. (A. M. N. H.).

Largus sellatus Guér. St. Augustine (Johnson).

Dysdercus andreæ Linn. Biscayne Bay (Mrs. Slosson).

Dysdercus mimus Say. Biscayne Bay (Mrs. Slosson).

Dysdercus suturellus Say. Charlotte Harbor, Belleair, Ormond (Mrs. Slosson); Punta Gorda, Nov., Ft. Myers, Nov., Titusville, Nov. (A. M. N. H.); Daytona, Nov. (Engelhardt); Ft. Myers, Apr., Everglade, Apr., Miami, Sept., Big Pine Key, Sept. (Davis); Runnymead (Banks); Lake City (Florida Exp. Sta.); Miami, Sept. (Sleight); St. Augustine (Johnson); Miami, Estero, Little River (U. S. N. M.); Lignum Vitae Key, Chokoloskee, Miami (My Collection).

Myodochidæ or Lygæidæ.

Oncopeltus fasciatus Dall. Sanford, Apr., Sevenoaks, Apr. (Van Duzee); Biscayne Bay, Charlotte Harbor, Jacksonville (Mrs. Slosson); Ft. Myers, Apr., Key, West, Sept., Big Pine Key, Sept. (Davis); Ft. Myers, Apr. (A. M. N. H.).

Oncopeltus sex-maculatus Stål. Lake Worth (Mrs. Slosson); Miami, Sept. (Davis). This is a Mexican and Central American species which has not hitherto been recorded from the United States. The three specimens collected by Mr. Davis at Miami are typical with the exception that the head and membrane are entirely black.

Lygæus albulus Dist. (= ?*Lygæosoma solida* Uhl), Crescent City, Apr. (Van Duzee); Newberry, Nov. (A. M. N. H.).

The specimens of *Lygæus albulus* Dist. which I have seen from Florida agree with specimens in my collection from Spearfish, So. Dakota and Wood's Hole, Mass. I am inclined to agree with Mr. Van Duzee that Distant's species is identical with *Lygæosoma solida* Uhler which was described from Mariposa Co., California in May, 1893. In this case, then Uhler's name must give way to that of Distant's which was described from Guatemala in January 1893.

Lygæus bicrucis Say. Charlotte Harbor, Atlantic Beach (Mrs. Slosson).

Lygæus facetus Say. Tampa, May (Van Duzee); Orange Grove (A. M. N. H.); Lake Worth, Charlotte Harbor (Mrs. Slosson); Lakeland, Mch. (Davis). This species has often been confused with *L. lateralis* Dall. which occurs in the western United States.

Lygæus formosus Blanch. Biscayne Bay (Mrs. Slosson); Miami, Sept. (Davis). I can find no record of this species having been reported from the United States. The specimens secured by Mr. Davis agree perfectly with others from Mexico and Lower California with which I have compared them.

Lygæus kalmii Stål. "Florida" (Ashmead's collection). I have not seen specimens of this species from Florida in any of the collections which I have examined and Mr. Van Duzee does not report it in his list. Uhler reported *L. turcicus* Fab. throughout the Atlantic and Gulf regions but as he did not differentiate this species from *L. kalmii* his records undoubtedly refer to the latter. Although *L. kalmii* and *L. reclivatus* may be varieties of the same species, it seems certain to me that *L. turcicus* is distinct and I have never seen it from south of Virginia.

Lygæus lineola Dall. "This insect seems to be a general inhabitant of the state

and was abundant especially toward the south." Crescent City, Sanford, Estero, St. Petersburg, Ft. Myers (Van Duzee); Jacksonville, Nov., Marco. Apr., Ft. Myers, Apr., Everglade, Apr. (Davis); Biscayne Bay, Lake Worth, Ormond, Jacksonville (Mrs. Slosson).

Lygæus mimulus Stål. "Common on the prairies at Haw Creek near Crescent City," St. Petersburg, Estero (Van Duzee); Miami, Nov., Ft. Myers (A. M. N. H.); Ormond (Mrs. Slosson); Daytona, Nov. (Engelhardt); La Grange, Sept., Big Pine Key, Sept. (Davis and Sleight).

Lygæus tripligatus sp. nov. (Ms. name of Uhler).

Dull brownish-black or obscure fuscous. Head with a small, pale spot at base. Antennæ concolorous, finely pilose, with the terminal joint a trifle paler; the first joint short, extended one-third its length beyond apex of head, second joint about three times as long as first and a trifle longer than third joint, fourth only a trifle longer than second joint. The bucculæ pale. The apex of rostrum reaching the posterior coxae, first and second joint subequal, third almost one-third longer than second joint. Pronotum broader than long with the anterior and posterior angles rounded and the posterior margin straight; posterior lobe with three orange-red marks, the median one, elongate-triangular, reaching about mid-way on the pronotum, the two lateral marks extending forward from the humeral angles to the middle line almost evenly expanded, posteriorly these humeral fasciæ are narrowly extended a short distance along the posterior margin; the lateral margins are impressed from base to apex forming a paler brown dividing line separating the reddish humeral spots from similar spots on the propleural angles beneath; the extreme anterior margin sometimes narrowly pale and lightly curved. Sternal parts slightly paler brown than the corium. Prosternum with the extreme narrow anterior and posterior margins and the acetabulæ pale luteous, the posterior angle reddish-orange; mesosternum with narrow posterior margin and acetabulæ pale luteous; acetabulæ of the metasternum pale and the rim of the stink gland orifices orange colored. Legs obscure fuscous, with fine pale pubescence; coxæ, trochanters and sometimes the bases of the femorae pale luteous, the tarsi paler than the femoræ. Scutellum carinate, concolorous, narrowly and obsoletely pale margined with the apex and faint median stripe, pale. Corium with the apical angles reddish orange and the extreme costal edge paler. Membrane brownish-black, veins concolorous. Venter brown-black, a little shining provided with golden brown pubescence, the lateral margins not conspicuously paler. Length ♂♂, 6–7 mm.

Described from two males. One in the collection of Mrs. Annie Trumbull Slosson which she took at Lake Worth, Florida and the other in my collection from Punta Gorda, Florida, and kindly presented to me by Mr. Otto Heidemann. I have seen other specimens in the Uhler collection at the U. S. N. M. For a long time this has remained in collections under the ms. name *tripligatus* of Uhler and I have thought best to adopt that name for this species. It belongs in the subgenus *Ochrostomus* Stål and should be arranged close to *lineola* Dall.

Nysius californicus Stål. "Abundant everywhere I collected in Florida" (Van Duzee); Sanford, Crescent City, Punta Gorda, Nov., Titusville, Nov., Key Largo, Nov., Lakeland, May and Nov. (A. M. N. H.); Biscayne Bay, Jacksonville, Atlantic Beach (Mrs. Slosson); Punta Gorda, Nov., Lakeland, May, Nov., Newberry, Nov., Jacksonville, Nov. (Davis); St. Augustine (Johnson); "Florida" (Uhler).

Nysius ericæ Schill. Miami, Nov. (A. M. N. H.).

Nysius inæqualis Uhl. "Florida" (Uhler); So. Jacksonville, Sept. (Davis).

Nysius longiceps Stål. Biscayne Bay (Mrs. Slosson).

Belonochilus koreshanus Van Duz. Ft. Myers, May, Estero, May (Van Duzee); Biscayne Bay, Charlotte Harbor (Mrs. Slosson); Lakeland, Nov., Jacksonville, Nov., Punta Gorda, Nov. (A. M. N. H. and Davis); Miami, Nov. (A. M. N. H.); Ft. Myers, Mch. (Davis).

Ninus notabilis Dist. "I found this insect very abundant everywhere I collected in Florida" (Van Duzee); Belleair, Ormond, Biscayne Bay, Lake Worth (Mrs. Slosson); Lakeland, Nov., Titusville, Nov., Punta Gorda, Nov. (A. M. N. H.).

Ischnorhynchus geminatus Say. Jacksonville, Nov. (A. M. N. H.).

Cymus angustatus Stål. Lake Worth (Mrs. Slosson).

Cymus bellus Van Duz. Sevenoaks, Apr., St. Augustine, Apr. (Van Duzee); Jacksonville (Mrs. Slosson).

Cymus breviceps Stål. Sanford, Apr., Crescent City Apr., Tampa, May, St. Petersburg, Apr. (Van Duzee); Biscayne Bay (Mrs. Slosson).

Ischnodemus badius Van Duz. Tampa, May, St. Petersburg, Apr. (Van Duzee); Clearwater (A. M. N. H.).

Ischnodemus lobatus Van Duz. Estero, May (Van Duzee).

Ischnodemus rufipes Van Duz. Crescent City, Apr., Clearwater, Apr., Estero, May (Van Duzee); Lake Worth, Ormond (Mrs. Slosson); Lakeland, Nov., South Bay of L. Okechobee, May (Davis).

Ischnodemus slossoni Van Duz. Jacksonville (Mrs. Slosson); Little River, Dec. (U. S. N. M.).

Blissus leucopterus Say. Ft. Myers, May, Sanford, Apr. (Van Duzee); Miami, Punta Gorda, Nov. (A. M. N. H.); Lake Worth, Biscayne Bay, Belleair, Ormond (Mrs. Slosson); So. Jacksonville, Nov., Everglade, Apr. (Davis).

Geocoris bullatus Say. Crescent City, Apr., Tampa, May, Estero, May, (Van Duzee); Biscayne Bay, Lake Worth (Mrs. Slosson); Lakeland, Nov. (Davis).

Geocoris piceus Say. Biscayne Bay (Mrs. Slosson).

Geocoris punctipes Say. "Abundant everywhere I collected in Florida" (Van Duzee); Jacksonville, Nov., Crescent City, Apr., Clearwater, Apr., Tampa, May, Sanford, Apr. (A. M. N. H.); Belleair, Biscayne Bay (Mrs. Slosson); Punta Gorda, Nov., Lakeland, Nov. (Davis).

Geocoris uliginosus Say. Crescent City, Apr., Sanford, Apr., Ft. Myers, May (Van Duzee); Charlotte Harbor, Belleair (Mrs. Slosson); Lakeland, Nov., La Grange, Sept. (Davis).

Phlegyas annulicrus Stål. "Florida" (Ashmead Collection).

Œdancala dorsilinea A. et S. "I found this species abundant everywhere I collected in Florida" (Van Duzee); Punta Gorda, Nov., Titusville, Nov., Lakeland, Nov., Jacksonville, Nov., La Belle, Apr., Ft. Myers, Apr., Crescent City, Apr. (A. M. N. H.); Lakeland, Nov., Punta Gorda, Nov., Ft. Myers, Apr., La Grange, Sept., So. Jacksonville, Sept. (Davis); Jacksonville (Mrs. Slosson).

It is probable that other records in literature, of *O. dorsalis* Say and *O. cubana*

Stål belong here as I have not been able to discover either of these species in the great amount of material I have looked over.

Paromius longulus Dall. Crescent City, Apr., St. Petersburg, Apr., Ft. Myers, May, Estero, May (Van Duzee); Biscayne Bay, Lake Worth, Jacksonville, Ormond (Mrs. Slosson); Silver Springs, Nov., Tampa, Nov. (Engelhardt); St. Augustine (Johnson); Lake City (Florida Exp. Sta.); Jacksonville, Apr., Sept., Nov., Lakeland, Mch., Nov., Punta Gorda, Nov., Newberry, Nov., Everglade, Apr., Ft. Myers, Mch., Apr. (A. M. N. H. and Davis); Key Largo, Nov., Titusville, La Belle, Miami, Clearwater, Sanford and Marco (A. M. N. H.); La Grange, Nov. (Davis); Duval Co. (U. S. N. M.).

Ligyrocoris abdominalis Guér. Ft. Myers, May (Van Duzee); Biscayne Bay, Lake Worth (Mrs. Slosson). This is the species recorded as *L. constrictus* Say, by Uhler who states that it "extends as far south as Mexico and Central America. It seems to be abundant in Cuba, and occasionally in the other large islands of the Antilles." From all of the evidence I can gather, I believe that *constrictus* Say belongs to the genus *Perigenes* Dist. and occurs only in the northern United States. I have seen specimens of *L. abdominalis* from Brazil and Venezuela in the collection of the U. S. N. M.

Ligyrocoris confraternus sp. nov.

Narrowly oval. Dull fuscous, sparingly setose. Head black with golden-yellow incumbent pubescence and sparsely setose, gradually constricted back of the eyes, this marginal part about one-half the length of the eyes. Ocelli are about twice as far apart as the space between them and the eyes and placed on an imaginary line drawn across the posterior boundary of the eyes. The antennæ infuscated, all of the joints more or less pale at base, the fourth, with the basal third conspicuously pale ringed; the basal joint extends for its apical one third beyond the apex of the head, the second joint about twice as long as the first, third joint about one-fourth shorter than second, the fourth joint about one fourth longer than third and almost subequal to second joint. Rostrum pale. Pronotum fuscous, setose, deeply constricted behind middle leaving the anterior lobe about one-fourth longer than posterior lobe, the latter finely punctate and with a short pale fascia either side of the middle before the posterior margin which is slightly concave. The sternum is fuscous, with the posterior angle of prosternum, the posterior margin of the metasternum and the acetabulæ fusco-ferrugineus. The coxæ are fuscous with the precoxal spine acutely prominent; the anterior femoræ are fuscous at base, the remainder of these and the apex of the second and third femoræ are spotted and marked with fuscous, apices of all tibiæ, tibial spines, and apices of first tarsal joint and all of the third joints infuscated. The anterior femoræ are furnished, in their apical two-thirds with a double row of spines, the inner row consists of three larger spines, the basal one about one-third distant from the base, the second one a little beyond the middle, the third, a little closer to the apex than to the post-median spine, between these last two and beyond the apical one are a number of smaller spines; the outer row has a tooth set midway opposite the space between the inner two larger teeth of the outer row and another opposite the space between the post-median and preapical spines, between which and the apex are several smaller teeth; these femoræ almost devoid of long setæ between the teeth. Scutellum fuscous, apex pale, long triangular, finely punctate, apically slightly carinate. Corium concolorous, finely punctate and finely

pubescent, the costal margins narrowly pale, interrupted by an elongate fuscous fascia behind middle and apical angle fuscous; near the inner angle before the posterior margin is a small round, pale spot. Commissure over a third as long as the scutellum. Membrane fuscous, broadly paler at base and sometimes with a few of the veins paler. Venter fusco-ferrugineus, somewhat shining and finely pubescent; genital segment of male more ferrugineus.

Length ♂ 5, ♀ 6 mm.

Described from two males from Everglade, Fla., Apr. 1912 and two females, one from Everglade, May 1912 and the other from Ft. Myers, Apr. 1912 collected by Mr. William T. Davis.

This species is closely related to *L. abdominalis* and with its pale ringed terminal antennal joint has, I believe, been mistaken for it. Besides being smaller it is less setose and more finely punctured than that species. The head is less suddenly constricted behind; the ocelli are placed relatively closer together; the first joint of the antennæ does not extend so far beyond the apex of the head; the first joint of the rostrum is pale; the anterior lobe of the pronotum is obviously longer than the hind lobe and the posterior margin not so concave; the legs are quite differently marked and the spines and setae of the fore femoræ are very characteristically different, for in *abdominalis* these are armed with a single row of teeth in their apical half as indicated by Stål, and provided with a number of long setæ; the commissure in *abdominalis* is very much shorter. *L. confraternus* agrees with *L. multispinus* Stål in having two rows of femoral spines.

Ligyrocoris slossoni sp. nov.

Rather elongate, narrow, dull. Head above and below red; eyes far removed from base, placed about midway between apex and base, the margins back of the eyes gradually contracted for a very short distance, thence sub-parallel to the base forming a wide neck; the ocelli are placed just back of the middle line of the eyes and a trifle closer to the eyes than to an imaginary longitudinal line midway between them. Apex of head reaching the middle of the basal joint of antennæ, all of first, second and base of third joints pale, apical two-thirds of the third infuscated, the fourth reddish with fine pale hairs; second joint about two and one-half times longer than basal and one-fourth longer than third, fourth a little shorter than the third joint. First joint of rostrum concolorous with head, its apex just reaching posterior line of eyes, a little shorter than second joint (the remainder hidden.) Pronotum constricted back of the middle, leaving the anterior lobe about one-third longer than the posterior lobe and a trifle narrower than the width of head across the eyes; this lobe castaneus, impunctate, the anterior collar reddish; the posterior lobe is much paler marked and sparsely punctured with castaneus. The sternum castaneus, the collar, the posterior angles, the acetabulæ, and posterior margins of the metasternum ochraceous-red. The first and second femoræ are red, paler at base; the tibiæ pale. (The hind pair of legs are missing.) The anterior femoræ are not much swollen and provided with a few small teeth arranged in a single row as follows: one-third

the distance from apex a single tooth and midway between this and apex a larger tooth, between the first two and beyond the pre-apical one are two or three minute teeth. The scutellum castaneus, reddish at apex and posteriorly keeled. The corium is pale-stramineous with a broad transverse post-median fascia, lines of punctures on the basal half and clavus and the apical angle, castaneus. Membrane entirely infuscated. Venter reddish-castaneus, somewhat shining.

Length of ♂ 5 mm.

Described from a single male in the collection of Mrs. Annie Trumbull Slosson, taken by her at Lake Worth, Florida.

This species is most closely related to *L. nitidicollis* Stål which was placed by that author in the genus *Pamera.* Stål likewise placed *L. setosa* in the same genus but it belongs undoubtedly to *Ligyrocoris* of which I am confident *Heraeus percultus* Distant is a synonym.

Ligyrocoris litigiosus Stål. Biscayne Bay (Mrs. Slosson).

Myodocha serripes Oliv. "Larva taken at St. Petersburg" (Van Duzee); "Florida" (Uhler).

Heræus plebejus Stål. Sanford, Apr. (Van Duzee); Everglade, Apr. (A. M. N. H. and Davis).

Heræus triguttatus Guér. Biscayne Bay (Mrs. Slosson).

Pamera basalis Dall. Crescent City, Apr. (Van Duzee); Biscayne Bay (Mrs. Slosson); Lakeland, Nov., Jacksonville, Nov. (A. M. N. H.).

Pamera bilobata Say. "Another common species found everywhere in the state" (Van Duzee); Charlotte Harbor, Jacksonville, Biscayne Bay, Atlantic Beach (Mrs. Slosson; Lakeland, Nov., Jacksonville, Nov., Titusville, Nov., Punta Gorda, Nov., Ft. Myers, Mch. (A. M. N. H.); Jacksonville, Nov., Ft. Myers, Apr., Everglade, May, Punta Gorda, Nov., L. Okechobee, May, La Grange, Nov., (Davis); Tampa, Nov. (Engelhardt); Miami, Nov. (U. S. N. M.); Leon Co. (my coll.).

There is quite evidently, to my mind, two distinct but closely related species placed in lists, as synonyms under this species. Scarcity of West Indian and Mexican material does not enable me to make a positive confirmation of my strong belief in this respect. Mr. Van Duzee in his list of Florida Hemiptera distinguishes one of these as probably *scutellatus* Dallas. This form always has the fourth antennal joint pale ringed at base, the anterior lobe of the pronotum relatively shorter than the typical *bilobata* and less swollen and the head a trifle more porrect. I should, however, call it *Pamera servillei* Guér. redescribed by Stål as belonging to *Plociomera* in his Hemiptera Mexicana, 312, 1862.

Pamera vincta Say. "Common everywhere I collected in Florida" (Van Duzee); Biscayne Bay, Lake Worth, Jacksonville, Belleair (Mrs. Slosson); Clearwater, Apr., Crescent City, Apr., Sanford, Apr., St. Petersburg, Apr., Ft. Myers, May, Lakeland, Nov., Key Largo, Nov., Punta Gorda, Nov., Miami, Nov., La Belle, Nov. (A. M. N. H.); Everglade, Apr., Lakeland, May (Davis); Daytona, Nov. (Engelhardt); Lake City (Florida Exp. Sta.).

Ptochiomera antennata Van Duz. Tampa, May (Van Duzee); Miami (A. M. N. H.).

Ptochiomera minima Guér. Titusville, Nov. (A. M. N. H.); Everglade, May, Miami, Sept. (Davis); St. Augustine (Johnson); "Florida" (Uhler).

Ptochiomera nodosa Say. Crescent City, Apr. (Van Duzee); Jacksonville, Lake Worth, Biscayne Bay (Mrs. Slosson); Titusville, Nov. (A. M. N. H.); "Florida" (Uhler).

Cnemodus mavortius Say. Punta Gorda, Nov. (A. M. N. H.); Jacksonville (Mrs. Slosson); Cleveland, Nov. (Davis).

Ozophora burmeisteri Guér. Everglade, Apr. (Davis); St. Augustine (Johnson).

Ozophora trinotatus sp. nov.

Dull, dark castaneus. Rather narrow elongate. Head sparsely setose, becoming fulvous anteriorly, gradually constricted back of eyes. Ocelli vitreus, about twice as far apart as each is removed from the eyes and set in an imaginary line running across posterior boundary of eyes. Apex of head not quite reaching middle point of basal antennal joint. Antennæ with the first three segments pale ochraceous, extreme apex of third and apical two-thirds of terminal joint infuscated; second joint about two and one-half times longer than basal, the third joint two-thirds the length of second, fourth joint almost as long as second and with the basal third pale ringed. Rostrum same color as the antennæ with apex of first joint reaching base of head, and subequal to second joint, third joint a little shorter. Pronotum concolorous with head, sparsely setose, the side margins narrowly carinate and shallowly constricted in the middle but dorsally, the anterior lobe appears slightly shorter than the posterior lobe; narrow collar is distinct; the anterior lobe impunctate, the posterior lobe finely and rather evenly punctate. The sternum only slightly darker castaneus than the pronotum, with the acetabulæ and sometimes with posterior margins of the metanotum pale; episternum anteriorly and the propleura back of the stricture punctate. Legs sordid ochraceous not banded with fuscous, all of the femoræ provided with long setæ; the anterior femoræ not much swollen, armed in their apical third with about three fine teeth. Scutellum with extreme apex pale, punctured in the center and along the sides, leaving a V-shaped smooth callosed area occupying the submargins. Corium more fuscous with the costal margins to beyond the middle, a subapical, irregularly quadrate spot and extreme apical angle minutely and contiguous part of membrane pale ochraceous; the clavus anteriorly and the base of the corium sometimes paler than the general surface; the fine punctures are arranged in linear series, especially on the clavus and along the veins, becoming more profuse beyond the subcostal vein. Membrane dark brown except for the paler marks along the outer basal margin. Venter only slightly darker castaneus than the sternum and finely setose.

Length 6 mm.

Described from ♂, Marco, Florida, Apr. 17, 1912 and ♀, Everglade, Florida, Apr., 11, 1912 (Coll. A. M. N. H.); 2 ♀'s, Ft. Myers, Florida, Mch. 31, 1912, and ♀, Everglade, Florida, Apr. 10, 1912 (Coll. Mr. William T. Davis); ♂, Ormond, Florida (Coll. Mrs. Annie T. Slosson). Mrs. Slosson also has this species from Biscayne Bay and Belleair.

This species is more closely related to *O. picturata* Uhl but besides being quite differently colored and marked it differs principally in having the pronotum less evidently constricted, in having long setæ on the femoræ and the spines on the fore femoræ arranged differently. In *burmeisteri* the fore femoræ are more swollen and differently spined.

Ozophora picturata Uhl. Biscayne Bay (Mrs. Slosson); Kissimmee (Banks); "Florida" (Ashmead).

Salacia pilosula Stål. Biscayne Bay (Mrs. Slosson).

Pygæus pallidus Uhl. Biscayne Bay (Mrs. Slosson); "Florida" (Uhler).

Peritrechus paludemaris sp. nov.

Elongate, oval; dull black and ochraceous, with very fine pale pubescence. Head sub-shining black, remotely punctate, about as long as the width across the eyes, its apex reaching just beyond the middle point of the basal joint of the antennæ. Antennæ piceous-black, rather thickly coated with fine hairs, second joint about twice as long as the basal joint, the third about one-third shorter than the second and the fourth subequal to the second joint. Apex of the rostrum reaching between the middle coxæ. Pronotum with the anterior lobe black, finely and very sparsely punctate, the region of the collum ochraceous, back of which is a cluster of punctures; the posterior lobe ochraceous, rather evenly and profusely punctured with fuscous; the pronotum is contracted anteriorly so that its diameter just back of the rounded anterior angles is very obviously less than the width of head across the eye; the side margins slightly sinuate just back of the middle point. Sternum dull black, sparsely punctate, the acetabulæ, anterior pro-sternal and posterior metasternal margins castaneous. Legs, with the coxæ, bases and extreme apices of the femoræ, the tibiæ, except at apex, castaneous; the tarsi, except at apex, paler; the fore femoræ for the most part, the median and hind femoræ on their apical halves, except the knees and apices of the tibiæ and tarsi piceous; the swollen fore femoræ armed midway with a short tooth, frequently absent, midway between which and the apices is a longer tooth. Scutellum fuscous, rather sparsely punctate posteriorly and provided apically with a V-shaped ochraceous mark. Corium mostly ochraceous with some fuscous patches contiguous to the posterior margin; fuscous punctures arranged in rows on the clavus and along the nervures, more profuse and irregularly placed without the subcostal nervure behind the middle. Membrane, especially at base pale, general surface faintly smudged with fuscous. Venter shining black, very minutely punctate and provided with a rather dense coat of incumbent pale hairs. Length 5–6 mm.

Described from numerous specimens in my collection taken along the edges of the salt marshes of Staten Island, Chesapeake Beach, Md. collected by Mr. Nathan Banks and one specimen from Everglade, Florida collected by Mr. William T. Davis in July.

So far as my knowledge goes this species is confined to the salt-marshes along the Atlantic coast. It is very closely related to *P. fraternus* Uhl., a widely distributed species in the United States. Besides being longer and relatively narrower, the head and antennæ are longer in proportion. The

most evident character by which to distinguish it from *fraternus* is the obviously narrower pronotum just back of the rounded anterior angle.

Aphanus umbrosus Dist. Florida (Mrs. Slosson); "Florida as *Microtoma carbonaria* Goeze."

Embethis vicarius Horv. Atlantic Beach (Mrs. Slosson).

Neididæ or Berytidæ.

Jalysus multispinus Ashm. (= *perclavatus* Van Duz.). Crescent City, Apr., Sanford, Apr., Tampa, May, St. Petersburg, Apr. (Van Duzee); "Florida" (Ashmead).

Jalysus spinosus Say. "Not at all abundant" (Van Duzee); Crescent City, Apr., Clearwater, Apr. (Van Duzee); Lakeland, Nov. (A. M. N. H. and Davis).

Metacanthus decorus Uhl. Estero, May (Van Duzee).

Aradidæ.

Aradus abbas Bergr. Atlantic Beach (Mrs. Slosson).

Aradus acutus Say. "Florida" (Uhler).

Aradus breviatus Bergr. Baldwin on *Toxodium* (U. S. N. M.).

Aradus falleni Stål. Crescent City, Apr., Sanford, Apr., St. Petersburg, Apr., Clearwater, Apr. (Van Duzee); Belleair (Mrs. Slosson); La Belle, Apr. (A. M. N. H. and Davis); Lemon City, Dec. (U. S. N. M.).

Aradus gracilicornis Stål. Crescent City, Apr. (Van Duzee); Lake Worth, Atlantic Beach (Mrs. Slosson).

Aradus minutus Bergr. "Southern Florida" (Heidemann).

Aradus quadrilineatus Say. "Florida" (Bergroth).

Aradus lugubris Fall. "Florida" (Uhler); "Florida" (Say).

Aradus similis Say. Charlotte Harbor, Biscayne Bay, Jacksonville (Mrs. Slosson).

Dysodiidæ or Brachyrhynchidæ.

Calisius anœmus Bergr. Biscayne Bay (Bergroth).

Calisius contubernalis Bergr. St. Goerge's Island (Bergroth).

Proxius gypsatus Bergr. "Florida" (Bergroth); St. Augustine (U. S. N. M. and Johnson).

Proxius schwarzi Heid. Tampa (Heidemann).

Mezira emarginata Say. Jacksonville (Mrs. Slosson).

Mezira granulata Say. Crescent City, Apr. (Van Duzee); Enterprise, Fernandina (U. S. N. M.); "Florida" (Uhler).

Mezira lobatus Say. "Florida" (H. Osborn).

Pictinus avrivillii Bergr. Crescent City (Heidemann).

Neuroctenus simplex Uhl. Biscayne Bay (Mrs. Slosson); Lakeland, Apr. on Live Oak (Heidemann); "Florida" (Uhler).

Aneurus politus Say. Belleair (Mrs. Slosson); St. Augustine (Johnson).

Corizidæ.

Harmostes affinis Dall. Ft. Myers, May (Van Duzee); Biscayne Bay (Mrs. Slosson); Key Largo, Nov. (A. M. N. H.); "Florida" (Bank's Cat.).

Harmostes reflexulus Say. "Common everywhere in Florida" (Van Duzee); Punta Gorda, Nov., Lakeland, May, Ft. Myers, Apr. (Davis); Jacksonville, Charlotte Harbor, Atlantic Beach (Mrs. Slosson); Lakeland, May and Nov., Titusville, Nov., Ft. Myers, Apr., St. Petersburg, Apr., Sanford, Apr., Clearwater, Apr. (A. M. N. H.); "Florida" (Uhler).

Corizus bohemani Sign. Lakeland, Nov., Miami, Nov., (A. M. N. H.); La Grange, Sept., Pablo Beach, Sept. (Davis); St. Augustine, Nov., Daytona, Nov. (Engelhardt).

Corizus hyalinus Fab. Estero, May (Van Duzee); Lake Worth, Biscayne Bay (Mrs. Slosson); Newberry, Nov. (A. M. N. H.); Jacksonville, Nov. (Davis).

Corizus lateralis Say. Sanford, Apr., (Van Duzee); Tampa, Nov. (A. M. N. H.).

Corizus punctatus Sign. Crescent City, Apr. (Van Duzee).

Corizus sidæ Fab. Crescent City, Apr., St. Petersburg, Apr. (Van Duzee); Ft. Myers, Apr. (Davis); "Florida" (Uhler).

Pyrrhotes hæmatoloma H. Schf. Sanford, Apr. (Van Duzee); Lakeland, May (A. M. N. H.); Everglade, Apr., May, June, Chokoloskee, Apr., Key West, Sept. (Davis); Lignum Vitae Key, Feb. (My coll. from Prof. E. B. Wilson); "Florida" (Uhler).

Coreidæ.

Corynocoris distinctus Dall. Crescent City, Apr., Estero, May (Van Duzee). "Florida" (Uhler). There is strong probability that these may be the next species.

Corynocoris typhæus Fab. Ft. Myers, Apr., Lakeland, May (Davis); Indian River District (My collection).

Because of their very close resemblance in color and markings this and the foregoing species have been much confused by entomologists. They are in fact so closely related that only a very careful study with the lens will show that principal characters for differentiation are found in the head as indicated by Dallas. *C. distinctus* occurs generally distributed over almost the entire United States, at least east of the Rocky Mts., extending south into Texas, Arizona and Mexico as shown by specimens in my collection. Like so many of our hemiptera the lines of dispersal of this species must have started in Mexico, one line proceeding around the Gulf strip of the lower austral zone and thence northwardly along the coast as far as New England and Canada, another line proceeding northward to spread out through all of the great Mississippi Valley. *C. typhæus* is confined so far as my knowledge goes to the extreme southeastern United States as I have only seen it from Florida. It differs from *C. distinctus* in having the head appearing much less quadrate, drawn out more in front between the bases of the antennæ which are a little more closely set together; the lateral spines are also placed closer together. The basal joints of the antennæ are not so stout, less hairy and more clavate shaped, being gradually narrowed from apex to base and slightly curved while in *distinctus* they are stouter and less narrowing from apex and more sharply constricted at base; the apical joint is relatively shorter in *typhæus*, more spindle shaped being quite evidently widest beyond the middle while in *dis-*

tinctus this joint is not so stout and almost parallel sided, suddenly constricted at base. In *typhæus* the rostrum is a little longer, its apex reaching just beyond the middle coxæ. I can find little difference in the curvature of the hind tibiæ in the two species.

Archimerus ashmeadi Mont. "Florida" (Montandon).

Archimerus calcarator Fab. Crescent City, Apr., Tampa, Apr., Ft. Myers, May, Estero, May (Van Duzee); Lakeland, Nov., Ft. Myers, Mch. and Apr. (A. M. N. H. and Davis); Biscayne Bay, Charlotte Harbor (Mrs. Slosson); Sanford (A. M. N. H.); Pablo Beach, Sept. (Sleight).

Mr. Van Duzee has already pointed out the differences between this and our more northernly *alternatus* Say.

Mozena obesa Mont. "Florida" (Montandon); Jacksonville (Mrs. Slosson); Enterpris (My collection from Wm. Beutenmuller.)

Euthoctha galeator Fab. "Taken at all stations but more abundant toward the south" (Van Duzee); Jacksonville, Biscayne Bay (Mrs. Slosson); Key Largo, Miami, Nov., Everglade, Apr., Lakeland, Mch. (A. M. N. H.); Lakeland, Nov., Ft. Myers, Apr., Everglade, Apr., Marco, Apr., Miami, Sept., La Grange, Sept., Key West, Sept., Big Pine Key, Sept. (Davis); Miami, Marathon, Dec. (U. S. N. M.); Leon Co., Mch., Miami, Feb., Indian River District, Apr., Chokoloskee (My collection).

Acanthocephala declivis Say. Chokoloskee (My collection); "Florida" (Uhler).

Acanthocephala confraterna Uhl. Biscayne Bay (Mrs. Slosson); Pablo Beach, Nov., Lakeland, Mch., Marco, Apr. (Davis); La Grange, Sept. (Davis and Sleight); Silver Springs, Daytona, Nov. (Engelhardt); Lake City (Florida Exp. Station); "Florida" (Uhler); Enterprise (My collection).

This species is closely related to and much resembles *femorata* in appearance but the abdomen is narrower, almost covered by the hemelytra while in *femorata*, considerable of the connexivum is exposed. The pronotum though granulated is not covered with small tubercles as in *femorata* and the lateral margins are not furnished with such evident teeth. In *confraterna* the first three antennal joints are brownish with the apical joint ferrugineus red; in *femorata* the joints are all concolorously reddish brown. In the male *confraterna* the hind femora are not nearly so much inflated, nearly straight and longer and though toothed beneath are unprovided with the enlarged median curved tooth so prominent in *femorata;* the hind tibiæ in this sex are also more expanded in *confraterna*.

Acanthocephala femorata Fab. "Not uncommon at most places where we collected" (Van Duzee); Ft. Myers, Apr., Nov., Lakeland, Mch., Nov., Miami, Nov., Key Largo, Nov., Sanford, Apr., St. Petersburg, Apr., Everglade, Apr., Chokoloskee, Apr., Punta Gorda, Apr. (A. M. N. H.); Biscayne Bay, Belleair, Atlantic Beach (Mrs. Slosson); Lake City (Florida Exp. Station); St. Augustine (Johnson and Engelhardt); Jacksonville, Nov., Everglade, Mch., Apr., Chokoloskee, Apr. (Davis); Pablo Beach, Sept. (Sleight); Enterprise, Apr. (My collection); "Florida" (Uhler).

Uhler has also recorded *A. terminalis* Dall. from Florida but I have been unable to confirm this.

Chondrocera laticornis La Porte. "Florida" (A. M. N. H.); Palm Beach, Georgiana, Key Largo (U. S. N. M.); Key Largo, Lignum Vitae Key (Van Duzee collection).

Leptoglossus balteatus Fab. "Florida" (U. S. N. M.).

Leptoglossus corculus Say. Ft. Myers, Nov. (A. M. N. H.); Miami Nov. (Engelhardt); "Florida" (Uhler).

Leptoglossus gonagra Fab. Daytona, Nov. (Engelhardt); Cutler (U. S. N. M.).

Leptoglossus magnoliæ Heid. "Florida" (U. S. N. M.).

Leptoglossus oppositus Say. Lake Worth (Mrs. Slosson).

Leptoglossus phyllopus Linn. Common throughout Florida and reported from every locality visited.

Although Banks has reported *zonatus* in his catalogue as occurring in Florida I am unable to confirm this and have considerable doubt about its occurrence there. This record probably refers to *balteatus* which it very closely resembles.

Phthia picta Drury. Punta Gorda, Nov. (A. M. N. H. and Davis); Big Pine Key, Sept. (Davis); Biscayne Bay (Mrs. Slosson); Miami, Nov. (Engelhardt); "Florida" (Uhler).

Spartocera confluenta Say. Crescent City, Apr., Clearwater, Apr. (Van Duzee); Biscayne Bay, Charlotte Harbor (Mrs. Slosson); Key Largo, Miami, L. Okechobee, May (A. M. N. H.); Everglade, Apr., June, Lee Co., Apr., Miami, Sept. (Davis); Lake City (Florida Exp. Station); Lake Worth (Heidemann); Chokoloskee (My collection).

Although *diffusa* Say has been reported from Florida by Uhler it is probably referable to the preceding species. I am firmly convinced that *diffusa* Say is distinct from *cinnamonea* Hahn from South America. *S. diffusa* Say occurs in North Carolina.

Sephina grayi Van Duz. "Florida" (Van Duzee); Miami, Sept. (Davis and Sleight); Georgiana (U. S. N. M.).

I have not seen a specimen of *S. gundlachi* from Florida although it is recorded in Bank's Catalogue. It should probably be referred to the preceeding species.

Chariesterus antennator Fab. Estero, May (Van Duzee); Key Largo, Punta Gorda, Nov. (A. M. N. H.); Charlotte Harbor, Lake Worth, Biscayne Bay, Atlantic Beach (Mrs. Slosson); Lakeland, Nov., Miami, Sept., Big Pine Key, Sept. (Davis); Indian River District (My collection); "Florida" (Uhler).

Margus obscurator Fab. Sanford, Apr., Crescent City, Apr., St. Petersburg, Apr., Ormond (Van Duzee); Lakeland, May, South Jacksonville, Sept. (Davis.).

Namacus annulicornis Stål. Ft. Myers (A. M. N. H. and Davis); Enterprise (U. S. N. M.).

This is a Mexican species hitherto unknown from the United States.

Catorhintha guttula Fab. Crescent City, Sevenoaks, Apr. (Van Duzee); Biscayne Bay (Mrs. Slosson); Miami, Nov. (Engelhardt); Jacksonville (Davis); "Florida" (Uhler).

Catorhintha mendica Stål. Biscayne Bay (Mrs. Slosson); Miami, Sept. (Davis); "Florida" (Uhler).

Anasa andresi Guér. "Florida" (Uhler).

Anasa armigera Say. "Florida" (Uhler).

Anasa scorbutica Fab. Biscayne Bay (Mrs. Slosson); "Southern Florida" (Uhler).

Anasa tristis de Geer. South Bay of L. Okechobee, Mch., Everglade, Apr. (A. M. N. H. and Davis); Jacksonville (Mrs. Slosson); Lee Co., Apr., Big Pine Key, Sept. (Davis); Miami, Silver Springs, Nov. (Engehardt).

Ceraleptus americanus Stål. Lakeworth (Mrs. Slosson).

Alydidæ.

Protenor belfragei Hagl. Ft. Myers, Apr. (Davis).

Leptocorisa tipuloides de Geer. Crescent City, Clearwater, Apr., (Van Duzee); Jacksonville, Sept., Nov., Lakeland, Nov., Punta Gorda, Nov. (A. M. N. H. and Davis); Pablo Beach, Sept., Nov., Ortega, Sept. (Davis); Daytona, Nov., Silver Springs, Nov. (Engelhardt); Belleair (Mrs. Slosson); Lake City, Nov. (Florida Exp. Station); St. Augustine (Johnson); Orland, May, on egg plant, Palm Beach (U. S. N. M.).

Hyalmenus longispinus Stål. Miami, Nov., Everglade, Apr. (A. M. N. H.); Biscayne Bay (Mrs. Slosson); Big Pine Key, Sept., Miami, Sept. (Davis); Little River (U. S. N. M.); Miami, Nov. (Engelhardt); Chokoloskee (My collection).

Alydus (*Burtinus*) *notatipennis* Stål. (= *A. femoralis* Dist). Miami, Sept. (Sleight). I have reported this Central American species from the Huachuca Mts., Arizona (Journ. N. Y. Ent. Soc., 37, 1910). Mr. Sleight's Florida specimen although somewhat darker, agrees in other particulars with the Arizona specimen. I have also very carefully compared this specimen with Distant's description and figure of *Alydus femoralis* in the Biologia and am convinced that this must be placed as a synonym of Stål's species *notatipennis.* In the specimens before me however the first segment of the antennae is longer than the second or third segment.

Alydus pilosulus H. Schf. "Common and widely distributed in Florida." (Van Duzee); Jacksonville, Nov., Lakeland, May and Nov. (Davis); Jacksonville, Nov., Titusville, Nov., Miami, Nov., St. Petersburg, Sanford, Crescent City (A. M. N. H.); St. Augustine, Nov., Daytona, Nov. (Engelhardt); Biscayne Bay, Ormond, Charlotte Harbor (Mrs. Slosson); St. Augustine (Johnson); "Florida" (Uhler).

Stachyocnemis apicalis Dall. St. Petersburg, Apr., Estero, May (A. M. N. H.); "Florida" (Uhler).

Pentatomidæ.

Amaurochrous dubius P. Beauv. Everglade, May (Davis). This West Indian species is almost two millimeters longer than the largest *A. cinctipes* I have seen, and easily distinguished from that species by the anterior angles of the pronotum being prolonged into oblique, elongated, stout, blunt processes which project well beyond the eyes; the humeral angle is sub-emarginate and the process before this is more prominently prolonged into a blunt tubercle; the lateral margins much more deeply sinuated. It has been reported from Virginia by Mr. Van Duzee.

Brochymena annulata Fab. Newberry, Nov., Jacksonville, Nov., Ft. Myers, Apr. (A. M. N. H. and Davis); Pablo Beach, Nov., La Grange, Sept. (Davis); Jacksonville (Mrs. Slosson and Engelhardt); Lake City (Florida Exp. Station); Archer, Mch. (U. S. N. M.); Barqueton (McAtee); Enterprise, Apr. (My collection).

Brochymena arborea Say. Lakeland, Apr. (A. M. N. H.); Silver Springs, Miami, Nov. (Engelhardt); Lake City (Florida Exp. Station); St. Augustine (Johnson); Georgiana (U. S. N. M.); Enterprise, Apr. (My collection); "Florida" (Uhler).

Brochymena cariosa Stål. Biscayne Bay, Tampa (Mrs. Slosson); "Florida" (Van Duzee).

Brochymena marginella Stål. "Florida" (Van Duzee).

Brochymena poeyi Guér. Biscayne Bay, Tampa (Mrs. Slosson); Orlando, Sept. (U. S. N. M.); Big Pine Key, Sept. (Sleight).

Brochymena quadripustulata Fab. Pablo Beach, Nov. (Davis); La Grange, Sept. (Sleight); Enterprise, Apr. (My Collection).

Trichopepla semivittata Say. Crescent City, Apr. (Van Duzee); "Florida" (My collection).

Pentatoma persimilis Horv. "Florida" (Mrs. Slosson).

Pentatoma saucia Say. St. Petersburg, Apr. (Van Duzee); Charlotte Harbor (Mrs. Slosson). This is a salt-marsh species occurring all along the Atlantic coast.

Mormidea lugens Fab. "Common everywhere we collected" (Van Duzee); Biscayne Bay (Mrs. Slosson); Lakeland, Crescent City, Clearwater, St. Petersburg, Titusville, Jacksonville, Ft. Myers (A. M. N. H.); Lake City (Florida Exp. Station); Pablo Beach, Sept., La Grange, Sept., Jacksonville, Sept., Ft. Myers, Mch., Lakeland, May, Sept. (Davis); Ortega, Sept. (Sleight); Enterprise, Apr. (My collection); "Florida" (Uhler).

Mormidea guerini L. and S. Everglade, June (Davis); This is what I take to be the *M. geographica* described by Guérin from Cuba and it has not hitherto been reported from the United States. It has much the appearance of *M. ypsilon* Linn. when fully colored but it is somewhat larger. Specimens from Cuba in the collection of the American Museum of Natural History show considerable variation in the extent of the yellow markings on the corium and scutellum; in some cases the corium and scutellum are unmarked with yellow.

Solubea pugnax Fab. "Taken occasionally at all stations" (Van Duzee); Jacksonville, Charlotte Harbor (Mrs. Slosson); Titusville, Punta Gorda, La Belle, Lakeland, May, Key Largo, Ft. Myers, Apr., Nov., Marco, Apr. (A. M. N. H.); Jacksonville, Punta Gorda, Lakeland, Nov., Marco, Apr., Everglade, Apr., La Grange, Sept., Big Pine Key, Sept. (Davis); Lake City (Florida Exp. Station); St. Augustine (Johnson); Indian River District (My collection); "Florida" (Uhler).

Euschistus bifibulus Pal. Beauv. Crescent City, Sanford, Apr., Estero, May (Van Duzee); South Bay of L. Okechobee, May, Everglade, Ft. Myers, Apr. (A. M. N. H.); Punta Gorda, Lakeland, May, Nov., Ft. Myers, Mch., Chokoloskee, Apr., Big Pine Key, Sept., La Grange, Sept., Miami, Sept. (Davis); Daytona, Nov. (Engelhardt); Lake City (Florida Exp. Station); Enterprise, Indian River Dist. (My collection).

Euschistus crassus Dall. Sanford, Apr. (Van Duzee); Clearwater, Ft. Myers, Apr., Lakeland, May (A. M. N. H.); La Grange, Sept. (Davis); Jacksonville (Mrs. Slosson); Leon Co. (My collection).

Euschistus crenator Uhl. Dade City, Nov. (U. S. N. M.); "Florida" (Uhler).

Euschistus ictericus Linn. Crescent City, Apr., Sanford, Apr., Ft. Myers, May, (Van Duzee); Lakeland, Nov., Ft. Myers, Apr., South Bay of L. Okechobee, May (A. M. N. H.); Ortega, Sept. (Davis); St. Augustine (Johnson); Enterprise (My collection); Kissemmee (Banks).

Euschistus servus Say. "Common everywhere in Florida" (Van Duzee); Crescent City, Sanford, Apr., Tampa, May, Ft. Myers, Mch., South Bay of L. Okechobee, May, La Belle, Apr., Lakeland, May (A. M. N. H.); Lakeland, May and Nov., Jacksonville, Nov., Newberry, Nov., Ft. Myers, Apr., La Grange, Sept., Miami, Sept. (Davis); Daytona, Nov. (Engelhardt); Lake City (Florida Exp. Station); Pablo Beach, Sept. (Sleight); Enterprise, Apr., Leon Co., Mch. (My collection); "Florida" (Uhler).

Euschistus tristigmus Say. Sanford, Apr. (Van Duzee); Jacksonville, Nov. (Davis); "Florida' (Uhler).

Euschistus variolarius Pal. Beauv. Sanford, Apr. (A. M. N. H.); St. Augustine (Johnson).

Proxys punctulatus Pal. Beauv. Sanford, Apr. (Van Duzee); La Belle, Nov., Ft. Myers, Mch., Apr. (A. M. N. H.); Chokoloskee, Apr., Ft. Myers, Apr., Everglade, June, La Grange, Sept. (Davis); St. Augustine (Johnson); La Grange, Sept. (Sleight); Chokoloskee (My collection); "Florida" (Uhler).

Hymenarcys nervosa Say. Ft. Myers, May (Van Duzee); "Florida" (Uhler).

Thyanta antiguensis West. Florida (Mrs. Slosson).

Thyanta casta Stål. Miami, Punta Gorda, Nov. (A. M. N. H.); Key West, Sept., Miami, Sept. (Davis); Miami, Feb. (My collection from Prof. E. B. Wilson).

Thyanta custator Fab. "Found at all points where I collected," Apr. May (Van Duzee); Lakeland, St. Petersburg, Jacksonville, Tampa, Clearwater, Ft. Myers, Miami, Newberry, Titusville, Nov. (A. M. N. H.); Lake City (Florida Exp. Station); Lake Worth, Charlotte Harbor, Jacksonville (Mrs. Slosson); Jacksonville, Lakeland, Punta Gorda, Nov., Ft. Myers, Mch., Lakeland, May, Miami, Sept., Cocoanut Grove, Sept. (Davis); St. Augustine, Miami, Nov. (Engelhardt); "Florida" (Uhler).

Thyanta perditor Fab. Key Largo, Nov. (A. M. N. H.).

I believe that this species is confined to the extreme southernmost part of Florida, although I have seen records from other parts of the state.

Loxa florida Van Duz. Crescent City, Apr. (Van Duzee); Biscayne Bay, Lake Worth (Mrs. Slosson); Jacksonville, Nov., Big Pine Key, Sept. (Davis and Sleight); Lignum Vitae Key, Feb. (My collection from Prof. E. B. Wilson).

The West Indian *L. flavicollis* Drury probably confused with the above has been reported from Florida.

Murgantia histrionica Hahn. Lake City (Florida Exp. Station); "Florida" (Uhler).

Murgantia violascens Westw. Key Largo (Van Duzee); Lignum Vitae Key, Feb. (My collection from Prof. E. B. Wilson).

Vulsirea violacea Fab. Biscayne Bay (U. S. N. M. and Mrs. Slosson); "Florida" (Van Duzee).

Nezara hilaris Say. Crescent City, Apr. (Van Duzee); Ormond (Mrs. Slosson); Newberry, Nov. (Davis); Daytona, Nov. (Engelhardt); St. Augustine (Johnson); "Florida" (Uhler).

Nezara marginata Pal. Beauv. "Southern Florida" (Uhler). I have been unable to confirm this record.

Nezara pennsylvanica De Geer. Sanford, Apr. (Van Duzee); Ft. Myers, Mch., Everglade, July (Davis); Jacksonville, Nov. (Davis and Engelhardt); Biscayne Bay (U. S. N. M.); Indian River Dist. (My collection).

Nezara viridula Linn. Crescent City, Clearwater, Sevenoaks, Apr. (Van Duzee); Pablo Beach, Newberry, Lakeland, Nov. (A. M. N. H. and Davis); Ft. Myers, Nov. (A. M. N. H.); Miami, Silver Springs, St. Augustine, Daytona, Nov. (Engelhardt); Lake City (Florida Exp. Station); Biscayne Bay (Mrs. Slosson); Everglade, May, So. Jacksonville, Sept. (Davis); Seven Oaks (Thurston); South Bay of L. Okechobee, May (A. M. N. H.).

Banasa dimidiata Say. Walton Co. (U. S. N. M.); Leon Co. (My collection from T. O'Connor); "Florida" (Say).

Banasa euchlora Stål. "Florida" (Uhler).

Banasa lenticularis Uhl. Crescent City, Apr. (Van Duzee); Lakeland, Jacksonville, Nov. (Davis); Silver Springs, Nov. (Engelhardt).

Banasa packardi Stål. St. Augustine (Van Duzee).

Piezodorus guildingi Westw. Green Springs, Apr. (Van Duzee); Punta Gorda, Nov. (Davis); St. Augustine (Johnson); Duval Co. (U. S. N. M.); "So. Florida" (Uhler).

Piezodorus incarnatus Germ. Jacksonville (Van Duzee).

Arvelius albopunctatus de Geer. Crescent City, Apr. (Van Duzee); Biscayne Bay (Mrs. Slosson); Key West, Miami, Sept. (Davis); Miami, Mch. (My collection); "Florida" (Uhler).

Neopharnus fimbriatus Van Duz. Florida (Van Duzee).

Brepholoxa heidemanni Van Duz. Biscayne Bay (Van Duzee).

Dendrocoris fruticicola Bergr. Sevenoaks, Apr., Tampa, Estero, Ft. Myers, May (Van Duzee); Jacksonville, Nov., Marco, Apr., Lakeland, May (A. M. N. H.); Lakeland, Nov., Marco, Apr., Ortego, Sept. (Davis); Lake City (Florida Exp. Station); Key West (Van Duzee); Palm Beach, Feb. (My collection); Duval Co. (Bergroth). I believe that Uhler was in error in recording this species from the arid southwest.

Edessa bifida Say. Crescent City, Clearwater, Apr., Ft. Myers, May (Van Duzee); Ormond, Biscayne Bay (Mrs. Slosson); South Bay of L. Okechobee, La Belle, May (A. M. N. H. and Davis); Miami, Sept. (Davis and Sleight); Pablo Beach, Sept. (Sleight); Miami, Nov. (Engelhardt); St. Augustine (Johnson); Kissimmee (Banks); Key Largo, Mch., Little River, Feb. (U. S. N. M.); Miami, Feb. (My collection); "Florida" (Uhler).

Stiretrus anchorago Fab. Var. *fimbriatus* Say. Charlotte Harbor, Lake Worth, Jacksonville (Mrs. Slosson); Sanford, Apr. (A. M. N. H.); Little River, Feb. (U. S. N. M.).

Var. *pulchellus* Westw. Crescent City, Apr., Ft. Myers, May (Van Duzee); Lakeland, May (A. M. N. H. and Davis); Indian River Dist., Apr. (My collection).

Var. *violaceus* Say. Sanford, Apr. (Van Duzee); St. Augustine (Johnson); Biscayne Bay, Atlantic Beach (Mrs. Slosson); Lakeland, May, La Grange, Sept. (Davis); South Bay of L. Okechobee, May (A. M. N. H.); "Florida" (Uhler).

Perilloides bioculatus Fab. Florida (My collection).

Mineus strigipes H. Schf. Florida (Brooklyn Museum).

Alcæorhynchus grandis Dall. Southern Florida (Van Duzee); Ft. Myers, Mch., Lakeland, Nov. (Davis); Archer (U. S. N. M.).

Alcæorhynchus phymatophora Pal. Beauv. Lake Worth, Biscayne Bay (Mrs. Slosson).

Apateticus cynicus Say. Jacksonville, Nov. (A. M. N. H.).

Apateticus maculiventris Say. St. Petersburg, May (Van Duzee).

Apateticus mucronatus Uhl. Ft. Myers, May (Van Duzee); Charlotte Harbor, Biscayne Bay, Lake Worth (Mrs. Slosson); St. Augustine (Johnson); Dade City, Sept. (U. S. N. M.); Palm Beach, Feb. (My collection); "Southern Florida" (Uhler).

Apateticus sagittata Fab. St. Augustine (Johnson); Miami, Sept. (Davis).

Apateticus serieventris Uhl. Ft. Myers, Apr. (Davis).

Euthyrhynchus floridanus Linn. Lakeland, Nov. (A. M. N. H.); Lakeland, Newberry, Pablo Beach, Nov., Miami, Sept. (Davis); Biscayne Bay, Lake Worth (Mrs. Slosson); Miami (U. S. N. M., Engelhardt, Sleight and My collection); Umatilla (Florida Exp. Station); St. Augustine (Johnson).

Thyreocoridæ.

Thyreocoris ciliata Uhl. Lake Worth (Mrs. Slosson); Ocean Beach, Sept. (Davis).

Thyreocoris lateralis Fab. "Common and widely distributed in Florida" (Van Duzee); Lakeland, Orange Grove, Sanford, Crescent City, Clearwater, Nov. (A. M. N. H.); Jacksonville, Nov., Ft. Myers, Apr. (Davis); Lake City (Florida Exp. Station); Orange Grove, May (My collection).

Thyreocoris minuta Uhl. Jacksonville (Van Duzee).

Thyreocoris pulicaria Germ. "Taken in abundance everywhere I collected in Florida" (Van Duzee); Jacksonville, Biscayne Bay, Belleair (Mrs. Slosson); Lake City (Florida Exp. Station); Punta Gorda, La Belle, Titusville, Tampa, Sanford, Ocean Grove, Nov., Ft. Myers, Marco, Apr., Lakeland, May (A. M. N. H.); Lakeland, Punta Gorda, Jacksonville, Nov. (Davis); Walton Co. (McAtee).

Thyreocoris unicolor Pal. Beauv. Crescent City, Sanford, Clearwater, Apr., Ft. Myers, May (Van Duzee); Ft. Myers, Apr. (A. M. N. H.).

Cyrtomenus mirabilis Perty. Clearwater, Apr. (Van Duzee); Biscayne Bay (Mrs. Slosson); Ft. Myers, Lakeland, Nov., Enterprise, Apr. (A. M. N. H.); Lakeland, May, Nov. (Davis); Daytona, Nov. (Engelhardt); St. Augustine (Johnson); "Florida" (Uhler).

Cydnus communis Uhl. St. Johns River. Orange Springs (Uhler).

Cydnus indentatus Uhl. Lakeland, Steinhatchee, Nov., Key West, Sept. (Davis); St. Augustine (Engelhardt); "Florida" (Uhler).

Pangæus bilineatus Say. Ft. Myers, Apr., Nov., Miami, Marco, Everglade, Apr., Lakeland (A. M. N. H. and Davis); Lake City (Florida Exp. Station); Atlantic Beach, Biscayne Bay (Mrs. Slosson).

Pangæus uhleri Sign. Key West, Nov. (Engelhardt).

Geotomus robustus Uhl. Tampa, May (Van Duzee); Lakeland, May, Nov. (A. M. N. H. and Davis); Jacksonville, Nov. (Davis); Florida (Mrs. Slosson).

Amnestus pusillus Uhl. Crescent City, Apr. (Van Duzee); Biscayne Bay (Mrs. Slosson); La Belle, Everglade, Apr. (Davis).

Sehirus cinctus Pal. Beauv. Florida (U. S. N. M.).

Scutelleridæ.

Tetyra arcuata Fab. Biscayne Bay (Mrs. Slosson); Key West, Sept. (Sleight); Key West (U. S. N. M.).

Tetyra bipunctata H. Schf. Lakeland, Nov. (A. M. N. H.); Biscayne Bay (Mrs. Slosson); Palm Beach, Daytona, Nov. (Engelhardt); St. Augustine (Johnson); Lake City (Florida Exp. Station); Capron (U. S. N. M.).

Chelysoma guttatum H. Schf. Ft. Myers, May (Van Duzee); Ormond (Mrs. Slosson); Lake City (Florida Exp. Station); Miami, La Belle, Rital, Nov. (A. M. N. H.); Lakeland, Jacksonville, Nov. (Davis); St. Augustine (Johnson and Engelhardt); Georgiana (U. S. N. M.); Indian River Dist. (My collection).

Diolcus chrysorrhœus Fab. Green Springs, Apr. (Van Duzee); Jacksonville (A. M. N. H.); St. Augustine (Johnson); Indian River Dist. (My collection).

Diolcus irroratus Fab. Punta Gorda, Nov. (A. M. N. H. and Davis); Biscayne Bay (Mrs. Slosson); Fernandino (U. S. N. M.).

Homœmus grammicus Wolff. Crescent City, Sanford, Sevenoaks, Apr., Estero, May (Van Duzee); Piunta Gorda, Newberry, Lakeland, Jacksonville, Nov., Ft. Myers, Apr. (A. M. N. H.); Charlotte Harbor, Jacksonville (Mrs. Slosson); Lakeland, May and Nov., Ft. Myers, Apr. (Davis).

Sphyrocoris obliquus Germ. Ft. Myers, Estero, May (Van Duzee); Key Largo, Miami, Titusville, Nov. (A. M. N. H.); Biscayne Bay (Mrs. Slosson); St. Augustine (Johnson); Ft. Myers, Apr. (Davis); Capron, Apr., Georgiana, Little River, Feb. (U. S. N. M.).

Symphylus deplanatus H. Sch. Enterprise (U. S. N. M.).

Camirus porosus Germ. Estero, May (Van Duzee); Biscayne Bay (Mrs. Slosson); Key Largo, Nov. (A. M. N. H.); "Florida" (Uhler).

Sub Order HOMOPTERA.

Cicadidæ.

Cicada biconica Walk. Key West, June (Acad. Nat. Sci. Phil.); Key West (Uhler); "Florida" (Macgillivray).

Cicada bicosta Walk. La Grange, Sept. (Davis); "Southern Florida" (Uhler); "Florida" (Macgillivray).

Cicada davisi Sm. and Gr. Miami, Georgiana (U. S. N. M.); Miami, Jan. (Davis); Miami, Sept. (Acad. Nat. Sci. Phil.).

Cicada erratica Osb. Pablo Beach, Sept., Big Pine Key, Sept. (Davis).

Cicada grossa Fab. (= *marginata* Say) Ormond (Mrs. Slosson).

Cicada hieroglyphica Say. "Apparently common throughout the southern portion of Florida" (Van Duzee); Ormond (Mrs. Slosson); Lakeland, Mch., May, La Belle, Apr., La Grange, Sept. (Davis); St. Augustine (Johnson).

Cicada lyricen de Geer. Lake City (U. S. N. M.); "Florida" (Sm. and Gr.).

Cicada reperta Uhl. "Florida" (Uhler).

Cicada sayi Sm. and Gr. La Belle, Apr. (Davis); "Florida" (U. S. N. M.).

Cicada sayi var. *australis* Davis. La Grange, Sept. (Davis).

Cicada similaris Sm. and Gr. Fernandino (U. S. N. M.); Jacksonville, Sept., La Grange, Sept. (Davis).

Cicada viridifascia Walk. (= *sordidata* Uhl, Distant.) "Southern Florida" (Uhler).

Cicada vitripennis Say. "Florida" (Uhler).

Melampsalta parvula Say. Tampa (Van Duzee); Lakeland, May (Davis).

Fulgoridæ.

Cyrpoptus belfragei Stal. Tampa (Van Duzee); St. Augustine, Nov. (Engelhardt and Johnson).

Cyrpoptus reineckei Van Duz. "Taken at all places where I collected in Florida" (Van Duzee); Estero (Mrs. Slosson); Jacksonville (Sleight); Sanford, Clearwater, St. Petersburg, Apr., Jacksonville, May (A. M. N. H.).

Nersia lingula Van Duz. Estero (Van Duzee); Punta Gorda, Lakeland, Nov. (Davis); Ormond (Mrs. Slosson); Punta Gorda, Nov. (A. M. N. H.).

Nersia microrhina Walk. Jacksonville, Lakeland (Davis); Ft. Myers, Lakeland, Nov. (A. M. N. H.); St. Augustine (Johnson).

Scolops angustatus Uhl. St. Augustine (Johnson).

Scolops desiccatus Uhl. Crescent City, Sanford (Van Duzee).

Scolops sulcipes Say. "Florida" (Uhler).

Phylloscelis atra Germ. St. Petersburg, Sevenoaks, Ft. Myers and Estero (Van Duzee); Ft. Myers, Jacksonville, Miami, Nov. (A. M. N. H.).

Phylloscelis pallescens Germ. Estero (Van Duzee).

Pelitropis rotulata Van Duz. Ft. Myers, Estero (Van Duzee); Lake Worth, Biscayne Bay (Mrs. Slosson).

Tangia sponosa Uhl. "Southern Florida" (Uhler).

Monopsis tabida Spin. "Florida" (Van Duzee).

Catonia picta Van Duz. Estero (Van Duzee).

Ellidiptera floridæ Walk. Newberry (Davis).

Ellidiptera pallida Say. "Florida" (Say).

Monarchis sordulenta Uhl. Lake Worth (Mrs. Slosson).

Bothriocera tinealis Burm. Charlotte Harbor, Biscayne Bay (Mrs. Slosson).

Bothriocera undata Fab. "Was taken everywhere I collected in Florida" (Van Duzee); Lake Worth, Biscayne Bay, Ormond (Mrs. Slosson).

Oliarus complectus Ball. St. Petersburg, Sevenoaks, Estero (Van Duzee); Key Largo, Nov. (A. M. N. H.).

Oliarus difficilis Van D. Belleair (Mrs. Slosson).

Oliarus placitus Van D. Ft. Myers, May (Van Duzee).

Oliarus quinquelineatus Say. Jacksonville (Mrs. Slosson).

Oliarus slossoni Van D. Belleair, Biscayne Bay (Mrs. Slosson).

Oliarus vicarius Walk. Estero, Ft. Myers, St. Petersburg, Clearwater, Sevenoaks, (Van Duzee); Jacksonville, Ormond, Charlotte Harbor (Mrs. Slosson); Marco, Apr. (A. M. N. H.); St. Augustine (Johnson).

Cixius dorsivittatus Van D. Crescent City (Van Duzee); Biscayne Bay (Mrs. Slosson); Everglade, Apr. (A. M. N. H.).

Œcleus borealis Van D. "Abundant at all places, especially towards the southern end of the state" (Van Duzee); Jacksonville, Ormond, Atlantic Beach (Mrs. Slosson) Clearwater, Apr., Sanford, May (A. M. N. H.).

Myndus slossoni Ball. Crescent City (Van Duzee); Biscayne Bay, Charlotte Harbor (Mrs. Slosson); Crescent City, Sanford, Apr. (A. M. N. H.).

Myndus delicatus Van D. "Florida" (Van Duzee)

Myndus enotatus Van D. Crescent City, Apr. (Van Duzee, Mrs. Slosson and A. M. N. H.); Ormond, Charlotte Harbor, Biscayne Bay (Mrs. Slosson); Sanford, Apr. (A. M. N. H.).

Myndus lunatus Van D. Sanford, Sevenoaks, Ft. Myers, Estero (Van Duzee).

Myndus pusillus Van D. Crescent City, Sevenoaks (Van Duzee); Ormond, Atlantic Beach, Charlotte Harbor (Mrs. Slosson).

Bruchomorpha jocosa Stål. Crescent City, Sanford, Sevenoaks, St. Petersburg, Tampa, Ft. Myers (Van Duzee); Lakeland, Nov. (A. M. N. H.).

Bruchomorpha pallidipes Stål. Crescent City, Estero (Van Duzee).

Bruchomorpha suturalis Melich. "Common throughout Florida." (Van Duzee); Ft. Myers, Lakeland, Newberry, Nov. (A. M. N. H.).

Bruchomorpha tristis Stål. Crescent City, Estero, Sevenoaks (Van Duzee).

Naso robertsoni Fitch. Estero (Van Duzee).

Aphelonema decorata Van D. Crescent City, St. Petersburg, (Van Duzee); Charlotte Harbor (Mrs. Slosson).

Hypteropterum punctiferum Walk. "Everywhere I collected in Florida" (Van Duzee); Jacksonville (Mrs. Slosson); Clearwater, Sanford, Tampa (A. M. N. H.).

Thionia bullata Say. Jacksonville (Mrs. Slosson).

Thionia simplex Germ. Sevenoaks (Van Duzee).

Acanalonia bivittata Say. Estero (Van Duzee).

Acanalonia latifrons Walk. Tampa, Ft. Myers, Estero (Van Duzee); St. Augustine (Johnson); Biscayne Bay (Mrs. Slosson); Lakeland (A. M. N. H.).

Acanalonia pumila Van D. Estero Island (Van Duzee); Biscayne Bay (Mrs. Slosson).

Acanalonia servillei Spin. "Florida" (Uhler).

Ormenis proxima Walk. "East Florida" (Walker).

Ormenis pruinosa Say. Sevenoaks, Estero (Van Duzee); Clearwater, Apr. (A. M. N. H.); St. Augustine (Johnson).

Ormenis rufifascia Walk. Ft. Myers, Estero, Clearwater (Van Duzee); La Grange, Sept. (Sleight); Sanford, Apr. (A. M. N. H.).

Ormenis septentrionalis Spin. St. Augustine (Johnson).

Cyarda melichari Van D. "Common everywhere in Florida" (Van Duzee); Sanford, Crescent City, St. Petersburg, Everglade, Tampa, Jacksonville, Newberry, Lakeland, Punta Gorda, Ft. Myers (A. M. N. H.).

Flatoides punctatus Walk. "Taken occasionally at all places where I collected in Florida" (Van Duzee); Biscayne Bay, Jacksonville (Mrs. Slosson); Marco, Ft. Myers, Clearwater, Lakeland, Punta Gorda (A. M. N. H.).

Otiocerus abbotti Kirby. Jacksonville (A. M. N. H.).

Otiocerus degeeri Kirby. Sevenoaks (Van Duzee); Jacksonville (A. M. N. H. and Davis); "Florida" (Uhler).

Cenchrea fulva Van D. Estero (Van Duzee).

Lamenia obscura Ball. Crescent City, Haw Creek (Van Duzee and A. M. N. H.).

Copiocerus irroratus Schwartz. Biscayne Bay (Mrs. Slosson).

Stenocranus dorsalis Fitch. Crescent City, Sanford (Van Duzee); Biscayne Bay (Mrs. Slosson); Crescent City (A. M. N. H.).

Stenocranus palætus Van D. Crescent City (Van Duzee and A. M. N. H.); Everglade, Apr. (A. M. N. H.).

Stenocranus saccharivorus Westw. Tampa (Van Duzee).

Kelisia parvula Ball. "Florida" (Van Duzee).

Megamelanus elongatus Ball. Crescent City, St. Petersburg, Estero Island (Van Duzee); Belleair, Biscayne Bay, Ormond (Mrs. Slosson).

?*Megamelanus spartini* Osb. St. Petersburg (Van Duzee); Belleair (Mrs. Slosson).

Megamelus marginatus Van D. Estero (Van Duzee); Ormond (Mrs. Slosson).

Megamelus seminigra Stål. "Florida" (Van Duzee).

Perigrinus maidis Ashm. Estero (Van Duzee).

Macrotomella carinata Van D. Crescent City, Ft. Myers (Van Duzee).

Pissonotus ater Van D. Crescent City, Tampa, Sevenoaks, Ft. Myers (Van Duzee); Titusville, Nov., Ft. Myers, Nov. (A. M. N. H.).

Pissonotus basalis Van D. Ft. Myers, Estero (Van Duzee).

Pissonotus brunneus Van D. Crescent City (Van Duzee).

Pissonotus delicatus Van D. Crescent City, Sevenoaks, Estero (Van Duzee).

Pissonotus marginatus Van D. Sevenoaks (Van Duzee).

Pissonotus pallipes Van D. "Florida" (Van Duzee).

Phyllodinus nitens Van D. St. Petersburg, Estero (Van Duzee).

Stobæra affinis Van D. Crescent City, Ft. Myers (Van Duzee); Biscayne Bay (Mrs. Slosson).

Stobæra concinna Stal. Biscayne Bay, Belleair (Mrs. Slosson).

Stobæra pallida Osb. Ft. Myers, Estero (Van Duzee); Newberry (A. M. N. H.); Nassau (Crawford).

Stobæra quadripustulata Van D. Estero (Van Duzee).

Bostæra nasuta Ball. Tampa, Sevenoaks (Van Duzee).

Liburnia albolineosa Fowler. Sevenoaks, Estero (Van Duzee); Titusville, La Belle (A. M. N. H.).

Liburnia andromeda Van D. Sevenoaks, Tampa (Van Duzee); Lakeland (A. M. N. H.); Biscayne Bay, Belleair (Mrs. Slosson).

Liburnia basivitta Van D. Crescent City (Van Duzee); Jacksonville (Mrs. Slosson).

Liburnia culta Van D. Biscayne Bay (Mrs. Slosson).

Liburnia detecta Van D. Crescent City, St. Petersburg (Van Duzee); Ormond, Biscayne Bay, Lake Worth (Mrs. Slosson); Titusville (A. M. N. H.).

Liburnia foveata Van D. Lake Worth (Mrs. Slosson).

Liburnia humilis Van D. Sanford, St. Petersburg (Van Duzee).

Liburnia laminalis Van D. Crescent City (Van Duzee); Belleair (Mrs. Slosson).

Liburnia osborni Van D. Estero (Van Duzee); Lakeland (Bradley).

Liburnia ornata Stål. Crescent City (Van Duzee).

Liburnia puella Van D. Crescent City, Sevenoaks (Van Duzee); Biscayne Bay, Belleair (Mrs. Slosson).

Liburnia pumila Van D. Belleair (Mrs. Slosson).

Liburnia seminigra Stål. Crescent City, Estero (Van Duzee); Miami (A. M. N. H.); Belleair, Ormond (Mrs. Slosson).

Liburnia slossoni Ball. Crescent City, Estero (Van Duzee); Biscayne Bay, Belleair, Lake Worth, Ormond (Mrs. Slosson).

Liburnia teapæ Fowl. Biscayne Bay (Mrs. Slosson).

Liburnia tuckeri Van D. St. Petersburg (Van Duzee).

Liburnia weedi Van D. Sanford, Crescent City (Van Duzee); Punta Gorda (A. M. N. H.).

Cercopidæ.

Tomaspis bicincta Say. Sanford, Ft. Myers (Van Duzee); Lake Worth, Biscayne Bay (Mrs. Slosson); Clearwater, Apr., Ft. Myers, Nov., Mch., Everglade, Apr. (A. M. N. H.).

Lepyronia angulifera Uhl. "Found in moderate numbers at all places where I collected in Florida" (Van Duzee); Biscayne Bay (Mrs. Slosson); Sanford, Clearwater, Crescent City, Ft. Myers, La Belle, Tampa, Punta Gorda, Lakeland, Newberry (A. M. N. H.).

Lepyronia quadrangularis Say. "Florida" (Ball).

Aphrophora quadrinotata Say. "Florida" (Ball).

Aphrophora saratogensis Fitch. Crescent City (Van Duzee); Jacksonville (Mrs. Slosson).

Clastoptera proteus var. *saint-cyri* Prov. Crescent City (Van Duzee).

Clastoptera proteus var. *vittata* Ball. Sevenoaks (Van Duzee).

Clastoptera xanthocephala Germ. "Abundant everywhere in Florida" (Van

Duzee); Biscayne Bay, Belleair (Mrs. Slosson); Clearwater, Sanford, Crescent City, Jacksonville (A. M. N. H.).

Clastoptera xanthocephala var. *glauca* Van D. Ormond, Biscayne Bay (Mrs. Slosson); St. Petersburg, Miami (A. M. N. H.).

Membracidæ.

Ceresa aculeata Van D. Estero (Van Duzee); Ormond, Jacksonville (Mrs. Slosson).

Ceresa brevitylus Van D. Crescent City, Sanford (Van Duzee and A. M. N. H.).

Ceresa patruelis Stål. "Florida" (Van Duzee).

Stictocephala diminuta Van D. Biscayne Bay (Mrs. Slosson).

Stictocephala festina Say. Crescent City, St. Petersburg (Van Duzee).

Stictocephala lutea Walk. Walton Co. (McAtee).

Stictocephala substriata Walk. "Abundant everywhere I collected in Florida" (Van Duzee); Belleair, Jacksonville, Ormond, Atlantic Beach (Mrs. Slosson); Sanford, Miami, Titusville, Lakeland, Jacksonville, Crescent City, La Belle, Ft. Myers (A. M. N. H.); St. John's Bluff, E. Florida (Walker).

Acutalis inornata Ball. Biscayne Bay (Mrs. Slosson).

Acutalis semicrema Say. St. Augustine (Johnson).

Acutalis tartarea Say. "Taken at all stations" (Van Duzee); Atlantic Beach, Jacksonville, Ormond (Mrs. Slosson); Sanford, Crescent City (A. M. N. H.).

Micrutalis calva Say. "Generally distributed in the state" (Van Duzee); Newberry (A. M. N. H.); Biscayne Bay, Belleair, Lake Worth, Ormond (Mrs. Slosson).

Telemona collina Walk. St. John's Bluff. E. Florida (Walker).

Telemona conica Walk. St. John's Bluff, E. Florida (Walker).

Telemona monticola Fab. Sevenoaks (Van Duzee).

Telemona praealta Fowl. Tampa (Van Duzee).

Telemona subfalcata Van D. Belleair (Mrs. Slosson).

Archasia glaeata Fab. Estero (Van Duzee); Jacksonville (Mrs. Slosson); St. Augustine (Johnson).

Smilia camelia Fab. Jacksonville (Mrs. Slosson).

Smilia fasciata A. and S. Lake Worth, Jacksonville (Mrs. Slosson).

Cyrtolobus arcuatus Emm. Ormond (Mrs. Slosson).

Cyrtolobus fenestratus Fab. Jacksonville (Mrs. Slosson).

Cyrtolobus nitidus Van D. Jacksonville (Mrs. Slosson).

Cyrtolobus ovatus Van D. Sanford, Estero (Van Duzee); Marco, Apr. (A. M. N. H.).

Cyrtolobus sculptus Fairm. Jacksonville (Mrs. Slosson).

Cytolobus tuberosus Fairm. Belleair (Mrs. Slosson).

Cyrtolobus tumidus Walk. St. John's Bluff, E. Florida (Walker).

Cyrtolobus vau Say. Belleair, Jacksonville (Mrs. Slosson).

Atymna inermis Emm. Jacksonville (Mrs. Slosson).

Antianthe expansa Germ. "Florida" (Van Duzee).

Ophiderma flavicephala Godg. "Florida" (Van Duzee).

Ophiderma salamandra Fairm. Tampa, Sevenoaks (Van Duzee); Jacksonville (Mrs. Slosson).

Idioderma virescens Van D. "Taken occasionally at all places where I worked" (Van Duzee); Estero (Van Duzee); Sanford, Clearwater (A. M. N. H.).

Idioderma varia Van D. Estero (Van Duzee).

Vanduzea triguttata Burm. St. Petersburg, Estero, Sevenoaks (Van Duzee); Jacksonville (Mrs. Slosson).

Entylia concisa Walk. Crescent City (Van Duzee).

Entylia sinuata Fab. Crescent City, Sanford, Ft. Myers (Van Duzee); St. Augustine (Johnson).

Umbonia orizimbo Fairm. "Florida" (Amy. and Serv.).

Platycotis quadrivittata Say. "Florida" (Goding); St. Augustine (Johnson).

Platycotis sagittata Germ. Crescent City, Sevenoaks (Van Duzee).

Enchenopa binotata Say. St. Augustine (Johnson).

Tylopelta brevis Van D. Crescent City (Van Duzee).

Centruchoides perdita A. and S. Jacksonville (Mrs. Slosson).

BYTHOSCOPIDÆ.

Bythoscopus robusta Uhl. Sanford, Ft. Myers (Van Duzee); Belleair (Mrs. Slosson).

Agallia constricta Van D. Crescent City, Sanford (Van Duzee and A. M. N. H.); Ormond, Jacksonville, Atlantic Beach (Mrs. Slosson).

Agallia deleta Van D. Crescent City, Sanford, Ft. Myers (Van Duzee); Belleair (Mrs. Slosson).

Agallia lyrata Baker. Crescent City (Van Duzee).

Agallia novella Say. Crescent City (Van Duzee).

Agallia sanguinolenta Provanch. Crescent City, Sanford (Van Duzee); Lake Worth (Mrs. Slosson).

Agallia variata Uhl. Lake Worth (Mrs. Slosson).

Idiocerus nervatus Van D. Crescent City (Van Duzee).

TETTIGONIELLIDÆ.

Aulacizes guttata Uhl. Ft. Myers (Van Duzee); Biscayne Bay (Mrs. Slosson); Ft. Myers, Deep Lake, Apr. (A. M. N. H.).

Aulacizes irrorata Fab. Lake Worth, Biscayne Bay (Mrs. Slosson); Crescent City, Sanford, Apr. (A. M. N. H.).

Oncometopia lateralis Fab. Crescent City, Sanford, Tampa (Van Duzee); Sanford, Clearwater, Jacksonville (A. M. N. H.); St. Augustine (Johnson).

Oncometopia undata Fab. "Found commonly throughout Florida" (Van Duzee); Jacksonville, Ormond (Mrs. Slosson); Clearwater, Sanford, Lakeland, Miami, Key Largo (A. M. N. H.); St. Augustine (Johnson).

Homalodisca triquetra Fab. Sanford, Sevenoaks (Van Duzee); Sanford, Clearwater (A. M. N. H.).

Tettigoniella occatoria Say. Crescent City, Sanford (Van Duzee); Crescent City (A. M. N. H.); Atlantic Beach, Jacksonville (Mrs. Slosson); "Florida" (Ball).

Kolla bifida fasciata Walk. (= *fuscolinella* Fowler). "Common everywhere in Florida" (Van Duzee); Biscayne Bay, Jacksonville, Belleair (Mrs. Slosson); Crescent City, La Belle, Ft. Myers, Lakeland (A. M. N. H.); "Florida" (Ball.).

Kolla geometrica Sign. "Common in Florida" (Van Duzee); Crescent City, Sanford (A. M. N. H.); Belleair (Mrs. Slosson).

Kolla hartii Ball. Ft. Myers, Estero (Van Duzee); Ormond, Biscayne Bay, Lake Worth (Mrs. Slosson); Ft. Myers, La Belle (A. M. N. H.).

Kolla similis Walk. Biscayne Bay (Mrs. Slosson); Miami (A. M. N. H.).

Diedrocephala coccinea Forst. Crescent City, Sanford, (Van Duzee and A. M. N. H.); Ft. Myers (Van Duzee); Jacksonville, Atlantic Beach (Mrs. Slosson); St. Augustine (Johnson).

Diedrocephala flaviceps Riley. St. Augustine (Johnson).

Diedrocephala versuta Say. "Taken everywhere in Florida" (Van Duzee); Biscayne Bay, Ormond (Mrs. Slosson); Sanford, South Bay of L. Okechobee (A. M. N. H.).

Dræculocephala acuta Walk. South Bay of L. Okechobee (A. M. N. H.); St. John's Bluff, E. Florida (Walker).

Dræculocephala floridana Ball. Charlotte Harbor (Mrs. Slosson); Everglade (A. M. N. H.).

Dræculocephala mollipes Say. Crescent City, Clearwater (Van Duzee); Belleair, Ormond, Lake Worth (Mrs. Slosson) South Bay of L. Okechobee (A. M. N. H.).

Dræculacephala mollipes minor Walk. "Taken in damp places and near water in most localities where I collected in Florida" (Van Duzee); Ormond (Mrs. Slosson); Ft. Myers, Lakeland, Crescent City, Sanford (A. M. N. H.).

Dræculacephala reticulata Sign. St. Petersburg, Estero (Van Duzee); Belleair. Biscayne Bay, Ormond, Jacksonville (Mrs. Slosson); Everglade, Marco, La Belle, Ft. Myers (A. M. N. H.).

Dræculacephala 7-guttata Walk. "Generally distributed but not common in Florida" (Van Duzee); Jacksonville, Ormond, Biscayne Bay, Belleair, Lake Worth (Mrs. Slosson); Titusville, Punta Gorda, Sanford (A. M. N. H.).

Penthima americana Fitch. "Taken everywhere in Florida" (Van Duzee); Charlotte Harbor, Biscayne Bay, Jacksonville (Mrs. Slosson); Clearwater, Sanford, Ft. Myers, Jacksonville (A. M. N. H.); St. Augustine (Johnson).

Gypona albosignata Uhl. Jacksonville (Mrs. Slosson).

Gypona cana Burm. "Common everywhere in Florida" (Van Duzee); Biscayne Bay, Jacksonville (Mrs. Slosson); Lakeland, Ft. Myers, Crescent City, Sanford, Jacksonville (A. M. N. H.).

Gypona citrina Spangb. Crescent City, Sanford (Van Duzee); Atlantic Beach (Mrs. Slosson).

Gypona flavilineata Fitch. St. Augustine (Johnson).

Gypona irrorella Spangb. Ft. Myers (Van Duzee); La Belle, Ft. Myers (A. M. N. H.).

Gypona rugosa Spangb. Belleair (Mrs. Slosson); Lakeland, Jacksonville (A. M. N. H.).

Gypona sanguinolenta Spangb. Sanford, Ft. Myers (Van Duzee); Jacksonville (Mrs. Slosson).

Gypona scarlatina Fitch. Miami (A. M. N. H.).

Gypona striata Burm. "Florida" (Van Duzee); Ormond, Biscayne Bay, Jacksonville (Mrs. Slosson).

Gypona tenella Spangb. Sanford, Sevenoaks (Van Duzee); Lakeland, May (A. M. N. H.); Biscayne Bay (Mrs. Slosson).

Xerophloea viridis Fab. Biscayne Bay (Mrs. Slosson); St. Augustine (Johnson).

Jassidæ.

Xestocephalus pulicarius Van D. Crescent City, Ft. Myers (Van Duzee); Everglade (A. M. N. H.).

Xestocephalus tessellatus Van D. Jacksonville, Belleair, Biscayne Bay, Charlotte Harbor (Mrs. Slosson); La Belle, Apr. (A. M. N. H.).

Dorycephalus vanduzei Osb. and Ball. Clearwater (Van Duzee).

Hecalus apicalis Van D. Crescent City, St. Petersburg, Estero (Van Duzee); Punta Gorda (A. M. N. H.).

Neoslossonia putnami Osb. Sanford (Van Duzee); Jacksonville (Mrs. Slosson).

Spangbergiella mexicana Baker. Biscayne Bay (Mrs. Slosson).

Spangbergiella vulnerata Uhl. Crescent City, Sanford, St. Petersburg, Ft. Myers (Van Duzee); Belleair, Ormond (Mrs. Slosson); Lakeland, Nov. (A. M. N. H.).

Parabolocratus flavidus Sign. "Taken at most of the places where I collected but not at all common" (Van Duzee); Punta Gorda, Nov. (A. M. N. H.).

Platymetopius cinereus Osb. and Ball. "Taken occasionally at all stations" (Van Duzee); Belleair, Jacksonville (Mrs. Slosson); Jacksonville, Nov. (A. M. N. H.).

Platymetopius frontalis Van D. Jacksonville, Biscayne Bay (Mrs. Slosson); Ft. Myers, Apr. (A. M. N. H.).

Platymetopius loricatus Van D. Sevenoaks, St. Petersburg, Ft. Myers (Van Duzee); Belleair (Mrs. Slosson).

Platymetopius nasutus Van D. Belleair (Mrs. Slosson).

Platymetopius slossoni Van D. Jacksonville (Mrs Slosson); Jacksonville, Newberry (A. M. N. H.).

Platymetopius verecundus Van D. Crescent City, Sanford, Sevenoaks, Clearwater, Estero (Van Duzee); Sanford (A. M. N. H.).

?Deltocephalus capreatus Ball. Sevenoaks (Van Duzee).

Deltocephalus colonus Uhl. Lake Worth, Biscayne Bay (Mrs. Slosson).

Deltocephalus flavicosta Stål. Biscayne Bay, Atlantic Beach (Mrs. Slosson); Lakeland, La Belle, Titusville, Key Largo, Everglade, Sanford (A. M. N. H.).

Deltocephalus fraternus Ball. Jacksonville (Mrs. Slosson); Lakeland, Newberry, Clearwater, Jacksonville (A. M. N. H.).

Deltocephalus fraternus mendosus Ball. Estero (Van Duzee).

Deltocephalus inflatus Osb. and Ball. Crescent City, Estero, Sevenoaks (Van Duzee).

Deltocephalus littoralis Ball. St. Petersburg (Van Duzee); Everglade, Apr. (A. M. N. H.).

Deltocephalus micarius Ball. Sevenoaks, Sanford (Van Duzee).

Deltocephalus miscellus Ball. Jacksonville, Nov. (A. M. N. H.).

?Deltocephalus nigrifrons Forbes. Lake Worth (Mrs. Slosson).

Deltocephalus obtectus Osb. and Ball. "Taken occasionally at nearly all places where I worked in Florida" (Van Duzee); Belleair, Biscayne Bay (Mrs. Slosson); Newberry, Jacksonville, Lakeland, Nov. (A. M. N. H.).

Deltocephalus reflexus Osb. and Ball. Belleair (Mrs. Slosson).

Deltocephalus slossoni Ball. Biscayne Bay (Mrs. Slosson).

Deltocephalus sonorus Ball. Estero, St. Petersburg (Van Duzee); Ormond, Belleair, Biscayne Bay (Mrs. Slosson).

Deltocephalus weedi Van D. Crescent City, Clearwater, Sevenoaks, Estero (Van Duzee); Biscayne Bay (Mrs. Slosson); Jacksonville, Nov. (A. M. N. H.).

Lonatura (?) bicolor Van D. Ft. Myers, Estero (Van Duzee).

Phrynomorphus bicolor Van D. Crescent City, Tampa, St. Petersburg (Van Duzee).

Phrynomorphus exitiosus Uhl. "Common everywhere in Florida" (Van Duzee); Biscayne Bay, Belleair, Ormond, Lake Worth, Jacksonville (Mrs. Slosson); Punta Gorda, Marco (A. M. N. H.).

Phrynomorphus obtusus Van D. Crescent City (Van Duzee).

Eutettix bartschi Van D. Sevenoaks, Estero (Van Duzee); Ormond, Biscayne Bay, Atlantic Beach (Mrs. Slosson); St. Petersburg, Miami (A. M. N. H.).

Eutettix lurida Van D. Titusville, Nov. (A. M. N. H.); St. Augustine (Johnson).

Eutettix marmoratus Van D. "Florida" (Ball).

Eutettix nitens Van D. Sevenoaks, Estero (Van Duzee).

Eutettix picta Van D. "Florida" (Ball).

Eutettix slossoni Van D. Sanford, St. Petersburg, Sevenoaks, Ft. Myers (Van Duzee); Biscayne Bay (Mrs. Slosson); Clearwater (A. M. N. H.).

Eutettix tristis Ball. "Florida" (Ball).

Phlepsius attractus Ball. Jacksonville (Mrs. Slosson).

Phlepsius cinereus Van D. Biscayne Bay (Mrs. Slosson).

Phlepsius collitus Ball. Jacksonville (Mrs. Slosson).

Phlepsius costomaculatus Van D. Belleair, Biscayne Bay (Mrs. Slosson); Crescent City, Sanford, Sevenoaks, St. Petersburg, Ft. Myers (Van Duzee); La Belle (A. M. N. H.).

Phlepsius decorus Osb. and Ball. Tampa (Van Duzee).

Phlepsius excultus Uhl. Crescent City, Sanford, Sevenoaks, Ft. Myers (Van Duzee); Jacksonville, Biscayne Bay (Mrs. Slosson); Crescent City, Sanford, Marco (A. M. N. H.); St. Augustine (Johnson).

Phlepsius floridanus Ball. Biscayne Bay (Mrs. Slosson).

Phlepsius fulvidorsum Fitch. "Florida" (Van Duzee).

Phlepsius fuscipennis Van D. "Common everywhere in suitable locations" (Van Duzee); Lake Worth, Belleair, Biscayne Bay, Jacksonville (Mrs. Slosson); Newberry, Punta Gorda, Nov. (A. M. N. H.).

Phlepsius irroratus Say. Jacksonville (Mrs. Slosson).

Phlepsius lippulus Ball. Biscayne Bay (Mrs. Slosson).

Phlepsius mimus Baker. Crescent City (Van Duzee).

Phlepsius nebulosus Van D. "Florida" (Van Duzee).

Phlepsius nudus Ball. Sevenoaks, Ft. Myers (Van Duzee).

Phlepsius punctiseriptus Van D. Belleair, Charlotte Harbor (Mrs. Slosson).

Phlepsius slossoni Ball. Biscayne Bay (Mrs. Slosson).

Phlepsius truncatus Van D. Crescent City, Sevenoaks (Van Duzee).

Dorydiella floridana Baker. "Florida" (Baker).

Acinopterus acuminatus Van D. Tampa, Sanford (Van Duzee); Biscayne Bay (Mrs. Slosson); Jacksonville, Newberry, Miami, Nov. (A. M. N. H.).

Scaphoideus albonatus Van D. Estero (Van Duzee).

Scaphoideus auronitens Prov. Biscayne Bay (Mrs. Slosson); Crescent City, Apr. (A. M. N. H.).

Scaphoideus consors Uhl. Crescent City (Van Duzee).

Scaphoideus cruciatus Osb. Marco, Everglade, Apr. (A. M. N. H.); Clearwater, Ft. Myers (Van Duzee); Biscayne Bay (Mrs. Slosson).

Scaphoideus immistus Say. Crescent City, Apr. (A. M. N. H.).

Scaphoideus jucundus Uhl. Estero (Van Duzee).

Scaphoideus neglectus Osb. Crescent City, St. Petersburg (Van Duzee); Biscayne Bay (Mrs. Slosson).

?Scaphoideus obtusus Osb. Crescent City, Sanford, Sevenoaks, Ft. Myers (Van Duzee).

Scaphoideus opalinus Osb. Sevenoaks (Van Duzee).

Scaphoideus scalaris Van D. Jacksonville, Nov. (A. M. N. H.).

Scaphoideus unicolor Osb. Sanford (Van Duzee).

Thamnotettix cornata Ball. Crescent City, Sanford, Sevenoaks, St. Petersburg (Van Duzee); Belleair (Mrs. Slosson); La Belle, Nov. (A. M. N. H.).

Thamnotettix orbonata Ball. Biscayne Bay (Mrs. Slosson).

Thamnotettix perpunctata Van D. Crescent City, Sanford, St. Petersburg (Van Duzee); Jacksonville, Ormond, Belleair, Atlantic Beach (Mrs. Slosson); Crescent City, La Belle, Titusville (A. M. N. H.).

Thamnotettix subcuprea Prov. Sanford, Sevenoaks, Ft. Myers (Van Duzee); Jacksonville (Mrs. Slosson).

Chlorotettix galbanata Van D. Ft. Myers (Van Duzee).

Chlorotettix minima Baker. Estero (Van Duzee).

Chlorotettix necopina Van D. Crescent City, Sanford, Sevenoaks, Clearwater (Van Duzee); Biscayne Bay, Ormond (Mrs. Slosson); La Belle, Titusville, Jacksonville, Sanford (A. M. N. H.).

Chlorotettix rugicollis Ball. "Taken at most places where I worked" (Van Duzee); Jacksonville (Mrs. Slosson); Jacksonville, Lakeland, Newberry, Ft. Myers (A. M. N. H.).

Chlorotettix spatulata Osb. and Bak. Jacksonville (Mrs. Slosson).

Chlorotettix tergata Fitch. "Florida" (Van Duzee).

Chlorotettix tunicata Ball. Sanford, Clearwater, Estero, St. Petersburg (Van Duzee); Belleair, Biscayne Bay (Mrs. Slosson); Marco, Sanford, Miami (A. M. N. H.).

Chlorotettix viridia Van D. "Taken at all places where I worked," St. Petersburg, Sevenoaks (Van Duzee); Belleair (Mrs. Slosson); Sanford, Clearwater (A. M. N. H.).

Jassus olitorius Say. "Common everywhere in Florida" (Van Duzee); Ormond, Belleair, Charlotte Harbor (Mrs. Slosson); Sanford, Estero, Clearwater, Crescent City, La Belle, Marco, Lakeland, Titusville, Jacksonville (A. M. N. H.); St. Augustine (Johnson).

Neocœlidia tumidifrons Gill. and Bak. Jacksonville (Mrs. Slosson).

Paracœlida tuberculata Baker. Sevenoaks (Van Duzee); Jacksonville (A. M. N. H.).

Tinobregmus vittatus Van D. Biscayne Bay (Mrs. Slosson).

Cicadula 6-notata Fall. Sanford, Ft. Myers (Van Duzee).

Balclutha impicta Van D. Crescent City (Van Duzee).

Eugnathodus abdominalis Van D. Sanford, Clearwater, Ft. Myers (Van Duzee); Biscayne Bay, Ormond (Mrs. Slosson).

Protolebra braziliensis Bak. Belleair, Biscayne Bay (Mrs. Slosson).

Empoasca flavescens Fab. Crescent City, Estero (Van Duzee).

Empoasca mali LeB. Crescent City, Sanford, Ft. Myers, Estero (Van Duzee); Jacksonville (Mrs. Slosson).

Empoasca unicolor Gill. Ormond (Mrs. Slosson).

Typhlocyba flavoscuta Gill. Sanford, Sevenoaks (Van Duzee).

Typhlocyba rubricata Van D. Crescent City (Van Duzee).

Erythroneura comes Say. Crescent City, Sevenoaks, Estero (Van Duzee); Jacksonville (A. M. N. H.).

59.7(75 6)

Article XXXII.— A NEW *SCORPÆNA* AND A RARE RAY FROM NORTH CAROLINA.

By John Treadwell Nichols.

The Museum has been presented by Mr. Russell J. Coles with the following rare fishes recently obtained for him by his captain Charlie W. Willis, at Cape Lookout, North Carolina.

Pteroplatea altavela (*Linné*).

Two grown embryos, one 17½, the other 15 inches in width, furnish probably the first definite North American record for this species.

Mr. Coles writes that unfortunately the mother was not kept. However the following data were secured.

On May 22, 1914, a very large ♀ was captured. Width 6 ft. 10 in., length (snout to tip of ventrals) 3 ft. 8 in., tail 12 in. It had two spines on the tail. This specimen contained four grown embryos, two on either side. Two of the embryos received by the Museum (No. 4745 and 4746) have each a single well-developed spine on the tail.

Scorpæna colesi sp. nov.

The type and only specimen, No. 4689, American Museum of Natural History, was collected in the bight of Cape Lookout, North Carolina, by Captain Charlie W.

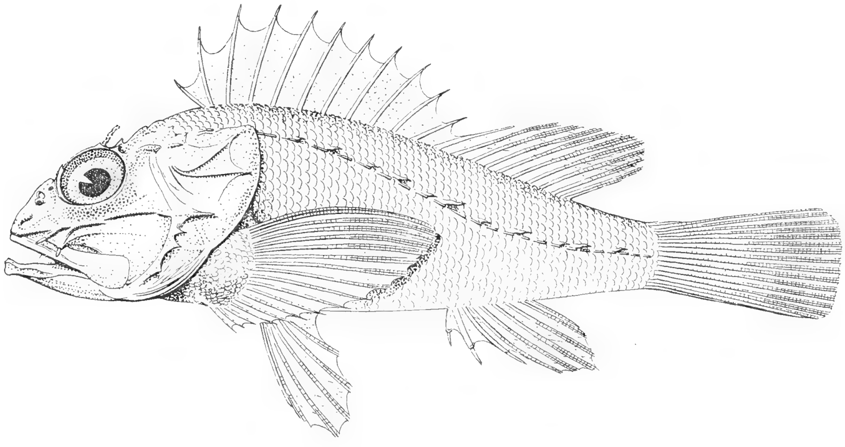


Fig. 1. *Scorpæna colesi* sp. nov.

Willis, April 23, 1914. It is 185 mm. long to base of caudal, depth 3.2 in this measure, head 2.5. Eye 3.7 in head, maxillary 2.2. The interorbital 2 in eye, snout 1.1;

short supraorbital cirrus about 2.5. The eyes are large, impinging on the dorsal contour, the interorbital strongly concave, a deep quadrangular pit at the occiput. The maxillary extends to between the posterior border of the pupil and that of the eye. Lower jaw very slightly projecting, symphysial knob prominent. The spines about the head are similar to those of *Scorpæna brasiliensis*, but weaker, the nuchal ones less divergent, the posterior nuchal separated by a greater distance ($\frac{2}{3}$ eye) from the origin of the spinous dorsal. Suborbital stay with four weak spinules. Bands of villiform teeth on jaws, vomer and palatines. Scales smooth and membranous, about 56 cross rows. Lateral line with about 14 membranous flaps, some of them large. Breast with small scales. Head scaleless. Dorsal XII, 10, anal III, 6. First dorsal spine $\frac{2}{3}$ second, the spines then increasing gradually to the fourth, fifth, and sixth, which are longest,—2.8 in head. Longest dorsal ray 2.0 in head. Third anal spine slightly longer and not quite so strong as second, 3.2 in head. Longest anal ray 2.1. Pectorals to origin of anal, 1.3; ventrals to vent, 2.0; caudal about even, 1.5. Color in spirits pale, three obscure dusky blotches on the middle of the side, scattered roundish dark spots on the side of the head, lower sides, and upper inner base of pectoral, the fins, except ventral and anal, faintly mottled, the caudal with a narrow dark tip. Color when caught bright pink.

This species differs from *Scorpæna brasiliensis* in the slightly larger eye and more prominent chin, smaller orbital cirrus and different color. Its habitat is probably deeper water.

It is named for Mr. Coles in recognition of his researches at Cape Lookout.

56.81.9A(117:71.2)

Article XXXIII.—*ANCHICERATOPS*, A NEW GENUS OF HORNED DINOSAURS FROM THE EDMONTON CRETACEOUS OF ALBERTA. WITH DISCUSSION OF THE ORIGIN OF THE CERATOPSIAN CREST AND THE BRAIN CASTS OF *ANCHICERATOPS* AND *TRACHODON*.

By Barnum Brown.

Plates XXIX–XXXVII.

Remains of the Ceratopsia are comparatively rare in the Edmonton formation, only ten specimens having been seen during four season's work of the American Museum parties. The rarity of this family in the Edmonton is in marked contrast to the Lance and Belly River formations where their remains are numerous. As the Edmonton is of brackish water origin and chiefly of water deposition the environment may not have been suitable to their presence in great numbers, certainly not to their preservation although remains of Trachodont dinosaurs are far more numerous than they are in the Lance.

The genera *Triceratops* and *Torosaurus*, so characteristic of the Lance formation, have not as yet been found in the Edmonton but two genera not heretofore known represent the family.

One genus, the subject of the present paper, is a large form represented in the collection of the American Museum by three fragmentary skulls and a separate supraorbital horn. Besides showing a unique type of crest this genus adds one more link in the morphological chain by which the ceratopsian crest has been developed.

Anchiceratops ornatus gen. et sp. nov.

Type of genus and species No. 5251, an incomplete skull, anterior end and top of supraorbital horns missing.

Horizon and locality. Edmonton formation, 50 ft. above river, 7 miles below Tolman Ferry, Red Deer River, Alberta, Canada.

Paratype, No. 5259, brain-case and supraorbital horns nearly complete. Same horizon and locality as type.

Generic and specific characters: Skull large. Supraorbital horns rising close together, massive at base and divergent, curving outward, then forward. Crest large, thick and flat with small lateral fontanelles; border ornamented by large epoccipital bones; a pair of short knob-like processes on superior posterior end of crest. Squamosal intermediate in length between *Monoclonius* and *Triceratops*.

The type specimen is the skull of an old individual in which the elements have reached the maximum development and so united that the sutures are in some places difficult to determine. When found most of it had weathered out. The ends of the supraorbital horns and all that part of the skull anterior to the frontals had evidently been broken away previous to fossilization as the fractured parts were covered over by sandstone.

The paratype was found a few miles further down the river in a gypsiferous clay stratum in which *Ostrea* and *Leurospondylus* occur. Some of the nerve openings were slightly crushed on one side but thanks to the skillful work of Mr. Otto Falkenbach a unique cast of the brain cavity has been made showing the semicircular canals for the first time in the Dinosauria.

A third specimen is a poorly preserved skull of a young individual broken in such manner that it exactly duplicates the parts preserved in the type. It verifies the characters pointed out in the type.

The extraordinary development of the epoccipital bones, the close-set, knob-like processes on the posterior end of the crest and the fontanelles give an unusual appearance to the skull. In each specimen the bone that forms the brain-case as well as that of the crest is unusually thick, with such surfaces as were not deeply embedded in muscle, furrowed by wide vascular grooves.

The crest (Plates XXIX and XXX) is broad, flat and quadrilateral in outline and on the upper surface is composed of three elements, as in other genera of the family; paired lateral bones suturally distinct and a median element, which is interpreted as the fused postfrontals ('parietals').

Styracosaurus albertensis Lambe (Ottawa Naturalist, Vol. XXVII, No. 9, pp. 109–116, 1913), from the Belly River formation, resembles *Anchiceratops* in some respects and may have been its ancestor. In both the crest is comparatively flat with occipital bones unusually developed but in this later form the squamosals are progressively lengthened, the lateral fontanelles are reduced and the exoccipitals are shortened. The development of the supraorbital horns is also distinctive.

The lateral paired bones are the squamosals, their relation to other elements precluding any doubt as to identification. The squamosal is elongate and terminates just in front of the third epoccipital bone counting from the rear, opposite the posterior border of the fontanelle. It is intermediate in length between that of *Monoclonius* and *Triceratops*. In front its extent cannot be determined above the free border but posteriorly it is well defined. The extreme anterior border is concave and the angle formed by the two borders is produced into a sharp process followed by the epoccipital bones.

The epoccipital bones are one of the most striking features of the skull.

They are extensive, covering the margin of the crest completely, all firmly coössified to the underlying bone but with sutural union distinct. On the squamosal there are six, the anterior five about equal in size, the sixth very much larger. This last large one is missing from the left side. Following these on each side are three epoccipitals equally of enormous size. They are attached to the border of the postfrontals ('parietals') and directed backward and outward. The surface is slightly roughened and they taper from the thick elongate base to the rounded point and thin borders.

Immediately above the base of the last epoccipital is a pair of massive, short, curved processes suturally united to each other and in the type specimen not distinct from the postfrontals below. In the skull of the young specimen, No. 5273, however, one of these processes was taken off and found to be united by suture to the supporting bone. They are large and curve outward ending in short blunt points. They differ slightly in form and position from the hook-like processes of *Monoclonius* but, as in that genus, probably served as attachment for muscles and were not sheathed in horn.

It is not yet clear, in the classification of the Ceratopsia, how much importance should be attached to the development of the horns and the peripheral outgrowths of the skull. The horns may have been of some use as offensive and defensive weapons but there is so much variation in size in closely related species that I am inclined to regard them as a sexual character. The epoccipital bones probably served the same purpose as similar structures in the living *Phryňosoma.* These excessive outgrowths were gradually reduced as the animals became more specialized and are subject to considerable individual variation.

The fontanelles are about half as large as in *Monoclonius* and wholly within the boundary of the postfrontals. This reduction of the fontanelles has been brought about by backward growth of the thin lateral walls, clearly foreshadowed in the skull of *Monoclonius.*

Anteriorly the thick central part of the postfrontals diverge to surround a small median oblong fossa which in the paratype has been freed of matrix. It opens into a large central chamber on each side underneath the supraorbital horns. These passages are entirely enclosed and do not communicate with the supratemporal fenestræ, but in front they communicate with the orbital cavity by a round opening 35 mm. in diameter, situated on the upper anterior border of the orbit 65 mm. from the outside. These passages do not communicate with the brain and probably related to the circulatory system.

Where the postfrontals diverge to form the border of the postfrontal fossa they are smooth bars over which blood vessels passed into the fossa from the supratemporal fenestræ. They are slightly below the rugose

surfaces in front and behind and in some specimens of *Triceratops* figured by Hatcher are entirely closed over by the upper surface of the postfrontals.

Lateral to the postfrontal fossa but distinct from it are the supratemporal fenestræ. These are at first elongate, narrow passages, the posterior border of which is formed by the squamosal and postfrontal. They open as in *Triceratops* posteriorly, this position having been brought about by the postfrontals overgrowing the parietals. Under the overhanging postfrontals they expand to large passages that communicate on the side of the face with the laterotemporal fenestra and open below in front of the quadrate. To the writer there seems little doubt of the identification of these passages.

The supraorbital horns (Plates XXXI and XXXII) are large as in *Triceratops* but differ in curvature. They approach each other in midline at the base nearer than in any described specimen of *Triceratops* except one figured by Hatcher (*loc. cit.*, pl. xxxvii) as *T. sulcatus*. They rise first upward and outward for a distance of half their length and then curve forward to the end and are divergent from origin to termination.

The orbit is large and circular, but the extent of the surrounding elements cannot be determined. The jugal forms the lower border of the orbit and continues down to overlap the quadrato-jugal. At the point of union a large pyramidal-shaped epijugal is attached equally to the jugal and quadrato-jugal. In *Triceratops* it is attached only to the jugal.

The laterotemporal fenestra is slightly larger than in *Triceratops* and as in that genus bordered by the jugal, the quadrato-jugal and the squamosal.

On the occipital of the type specimen the sutures separating the exoccipitals from the squamosals and the upper border of the parietals are well defined and the lower border of the parietal is indicated. In the paratype (Plate XXXIII) both upper and lower borders of the parietal are well defined. They have about the same extent as shown in the reproduction of *Triceratops horridus* (Monograph of the Ceratopsia, p. 121) where the elements are correctly identified.

The quadrate and quadrato-jugal are similar in form and extent to those of *Triceratops*.

Measurements.

	mm.
Width of squamosals, widest part	1300
" between orbits, top of border	340
Greatest length of squamosal, antero-posteriorly, outer border	320
" " " three posterior epoccipital bones	180
Postfrontal fontanelle diameter, antero-posteriorly	240
" " " transversely	175
Width postfrontal narrowest part between fontanelles	85
Diameter of horns at base, anteroposteriorly, paratype	150
Height of horns above superior border of orbit	570
Width across ends of horns, restored	950

Origin of the Ceratopsian Crest.

If we compare a series of skulls (Text-fig. 1) of *Monoclonius, Anchiceratops* and *Triceratops,* representing respectively the succeeding geological formations, Judith River, Edmonton and Lance, the squamosals are seen to lengthen in each succeeding type and the lateral fontanelles, which were very large in *Monoclonius,* are much reduced in *Anchiceratops,* and have entirely disappeared in *Triceratops.* Thus we see a gradual backward extension of the squamosal correlated with a lateral expansion of the central part of the crest.

This central part of the crest has received a variety of interpretations. Marsh first identified it as the fused parietals, an interpretation that has been followed by most writers, including Hatcher and Lull in the Monograph of the Ceratopsia, (Monograph 49, U. S. Geol. Surv., 1907). Dr. O. P. Hay (Proc. U. S. Nat. Mus., Vol. XXXVI, pp. 95–108, 1909) showed that this interpretation could not be accepted and suggested (p. 97) that this part of the crest might be the fused supratemporals or possibly coalesced nuchal bones such as are found in the crocodiles. Later von Huene (Neues Jahrbuch für Min., Geo., Pal., 1911, Bd. II, pp. 146–162) identified the anterior end of the central part as parietal and the posterior end as a dermo-supraoccipital, an interpretation that from latest discoveries does not seem acceptable.

From the progressive lengthening of the squamosal in succeeding Ceratopsia it is evident that the central portion of the crest was developed first, probably as a posterior bar analogous to the crest of *Saurolophus,* a genus of the Trachodontidæ recently described by Brown (Bull. Am. Mus. Nat. Hist., Vol. XXXI, pp. 131–136, 1912).

In *Saurolophus* the parietal does not enter into the composition of the crest, the suture separating them being well defined. The crest is composed of the prefontals, frontals, and nasals. In the Ceratopsidæ the frontals are short, terminating in front of the orbit. But the postfrontals which support the supraorbital horns are apparently carried back as a solid continuous bar on each side uniting back of the postfrontal fossa to form the central portion of the crest.

Thus in the Ceratopsidæ the top part of the skull has continued to grow backward pushing the parietal downward so that no part of it appears on the upper surface. The extent of the parietals as well as of the supraoccipitals is clearly shown in the figure of *Triceratops horridus* (Monograph of the Ceratopsia, p. 121).

From the series of Ceratopsid skulls now in the American Museum it seems clear that the posterior crest is composed of the two lateral squamosals and the fused central postfrontals.

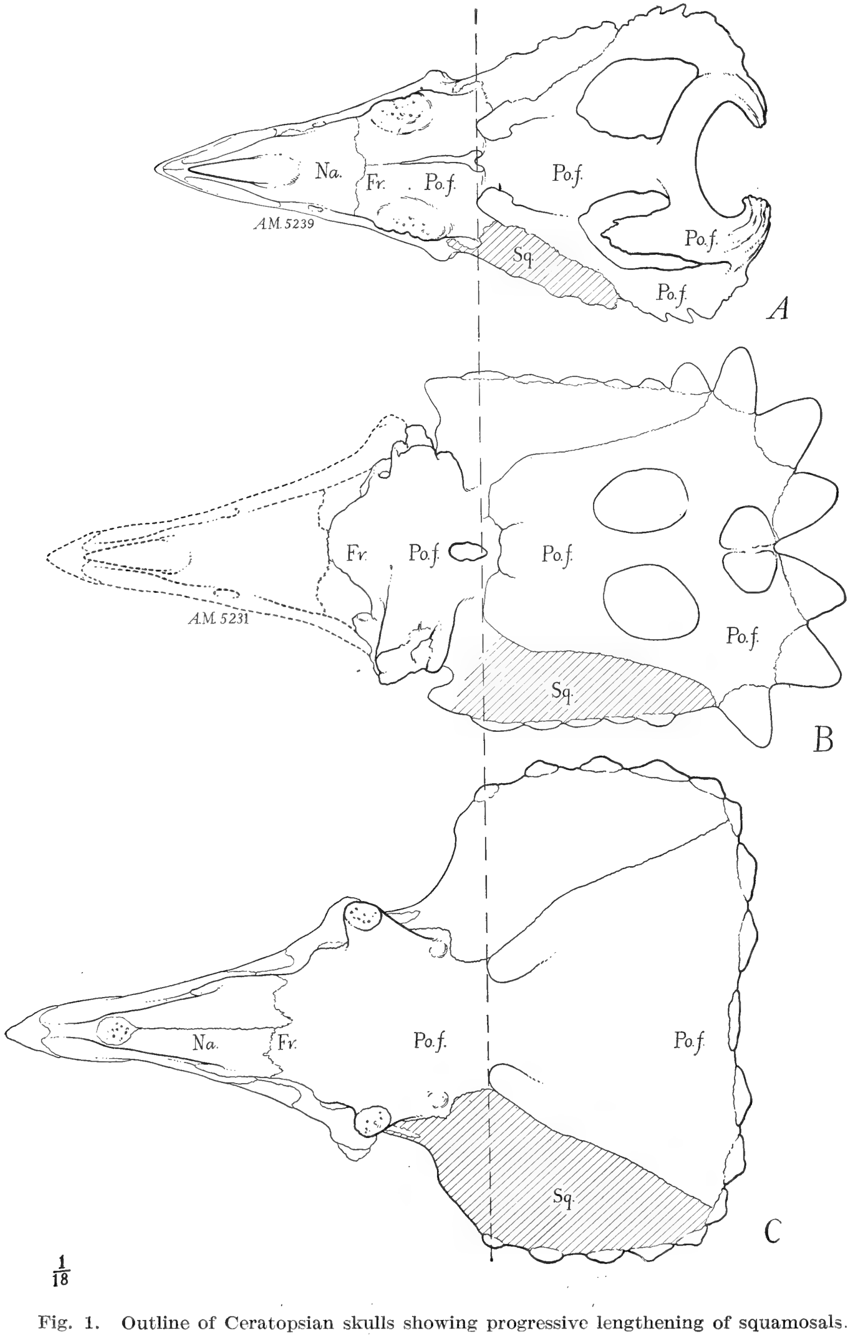


Fig. 1. Outline of Ceratopsian skulls showing progressive lengthening of squamosals. A, *Monoclonius;* B, *Anchiceratops;* C, *Triceratops.*

Brain Casts of *Anchiceratops* and a Trachodont.

In the course of preparation of the paratype it was possible to make a cast of the brain (Plates XXXIV and XXXV) that in accuracy of detail has rarely been equalled in fossil crania. In this cast, as in all others prepared under my direction, the nerve courses have been continued through the brain-case to the point of exit at which the surrounding bone converges to form the opening. This method exaggerates the length of the nerves as well as their diameter at the terminal section but it is the only way to show the fenestræ, the course of the nerves and the thickness of the investing walls of the brain-case at such points. In this specimen the normal direction of part of the fifth and seventh nerves has been changed through crushing and the cerebral hemispheres are crushed almost flat.

As has been remarked by other writers, the form of the brain in reptiles can only be deduced approximately from the cast of a brain cavity because the brain is loosely invested in the dura mater and does not completely fill the cavity. I find, however, that in the Dinosauria the form of the brain and its divisions are most clearly defined in the carnivorous forms.

However diverse may be the modification of external bones of the skull those forming the inner walls of the brain-case have the same definite relation to each other throughout the Dinosauria. Each has a constant relation to a definite part of the brain, and there is slight variation in the nerve exits. If the nerves can be determined accurately the brain becomes the final arbiter of those elements that enclose it.

It may be remarked that all of the elements of the reptilian skull are recognizable in the Trachodontidæ, that the skull differs in minor respect from the Iguanodontidæ, and is of a much more generalized type than that of the Ceratopsidæ. A fragmentary uncrushed brain-case (Plate XXXVI) of a Trachodont dinosaur, No. 5236, collected in the Edmonton formation in 1911, offered exceptional opportunities for comparison with the brain of *Anchiceratops*, consequently it was sectioned and a cast made of the cavity (Plate XXXVII). In this specimen the supraoccipital and parietal are complete and the posterior half of the alisphenoid is present; that part of the brain-case that enclosed the cerebral hemispheres is missing.

The dinosaur brain can readily be divided into three general regions, cerebrum, cerebellum and medulla oblongata. Invariably the brain cast in a dorsal view shows a marked constriction on the sides between the medulla oblongata and the cerebellum. This constriction is formed by the enlarged otic mass marking the position of the semicircular canals. In the side view of the Trachodont brain-case (Plate XXXVII, B) there are six openings visible and almost in line. The anterior and largest of these is the

foramen ovale for transmission of the three divisions of the fifth or trigeminal nerve. It is almost circular in outline, 17 mm. in diameter where it opens into the brain, and 27 mm. in diameter on the outside of the brain-case. Following this is a small opening which on the outside is divided by a narrow transverse bridge of bone, the upper division passing upward and backward, the lower division continuing downward on the side of the brain-case as an open channel. Both of these divisions are considered to be the passage of the seventh or facial nerve. Immediately back of the exit of the seventh nerve is seen a large somewhat square depression at the lower end of which a canal penetrates directly into the brain cavity. This circular canal, 4 mm. in diameter, is undoubtedly for the passage of the eighth or auditory nerve. Immediately in front of it at the base of the depression a funnel-shaped opening extends downward and backward within the mass of bone below the bridge of the seventh nerve, and immediately above it there is a larger opening which extends inward and upward into the otic mass but does not penetrate the inner wall of the brain-case. In this specimen and also in the brain-case of *Anchiceratops* these openings were sectioned independently and thoroughly explored. The former funnel-shaped opening is undoubtedly the fenestra rotunda enclosing the cochlea, the nature of which could not be determined. The upper, larger opening is the fenestra ovalis which continues into the semicircular canals. In this specimen the matrix was so hard that the semicircular canals were explored only on the left side and do not appear in the brain-cast on the right side. These canals have the normal reptilian position and open freely from one to the other with distinct ampullæ at the origin, but the horizontal is much shorter and smaller than either the anterior or posterior divisions. Immediately back of the eighth nerve is a depression in the bottom of which there is a large elliptical opening with the greatest diameter vertical. This foramen passes in just back of the otic mass and slightly above the internal opening of the eighth nerve. It is the foramen lacerum posterius, the common opening for the ninth, tenth and eleventh nerves. On the inner side of the brain-case just back of and below the foramen lacerum posterius there is a small foramen which runs upward and then opens into it, probably the passage of the jugular vein. Back of the common passage of the ninth, tenth and eleventh nerves there is a smaller foramen which opens into the depression of the foramen lacerum posterius, probably a passage for the transmission of the anterior condyloid artery. Back of the anterior condyloid foramen in line with the other openings is the large foramen for the transmission of the twelfth nerve. In the longitudinal section of this brain-case the union and extent of the elements forming the brain-case are clearly shown, and besides the foramina before mentioned there is just below the seventh and about 10 mm. behind

the fifth, the opening for the sixth nerve which passes directly forward through the basisphenoid.

On the upper surface of the brain-case there are five foramina which appear on the cast as processes of the cerebellum. They are invariably situated in suture lines and all probably transmitted veins. The central one on top and the next below it on each side are situated in the suture between the parietal and the supraoccipital and in life undoubtedly passed through the brain-case. The largest of these diverticulæ on each side is directly above the foramen ovale and 25 mm. from it, between the parietal and the proötic. In other brain casts of *Trachodon* and *Tyrannosaurus* there are additional diverticulæ given off from the cerebral hemispheres which mark the suture line between parietal and frontal.

These diverticulæ are most important in determining the position and extent of the parietal. They vary in number but are present in all casts that I have examined of *Trachodon, Triceratops, Anchiceratops* and *Tyrannosaurus* wherever the brain-case has been carefully sectioned and probed. In *Triceratops* and *Anchiceratops* there are two large processes on the cerebellum and two on the cerebrum and in *Anchiceratops* they pass into but do not penetrate the suture lines shown in Plate XXXIII defining the extent of the parietal.

In the brain-case of *Anchiceratops* the nerve openings follow the same plan as those of *Trachodon* with the following exceptions. In the crowding back of the skull elements the alisphenoid has entirely enclosed the ophthalmic branch of the fifth nerve, V^1 which passes entirely through it whereas in *Trachodon* V^1 is indicated simply as an uncovered channel. In this specimen the semicircular canals were opened and the cast made from them, but the cochlea was not preserved, if indeed it is present as a distinct division in this form. This specimen shows clearly that Dr. Hay (*loc. cit.*) was in error and that Hatcher was correct in describing the opening of the ninth, tenth and eleventh nerves. This opening does appear as Hatcher has described it just in front of the twelfth nerve, back of that part of the exoccipital which extends down to the basioccipital process. It extends forward, however, and opens into the brain-case with the eighth nerve in the present case. The passage appears to be broken on both sides in this specimen. On the inside of the brain-case shown in the cast (Plates XXXIV and XXXV), between the common opening of the ninth, tenth, eleventh, and that of the twelfth nerves there is a small opening determined, as in *Trachodon* as the anterior condyloid foramen for transmission of a vein. Opening directly from the foramen ovalo on the left side are two small canals that pass into the brain at the base of the seventh. These were probably for transmission of veins. The pituitary body is quite large and shows at its

posterior end a long central process and on either side the entrance of the carotid arteries. Anteriorly there are two similar processes, the ophthalmic branches of the internal carotid artery.

EXPLANATION OF PLATES.

Plate XIX. Skull of *Anchiceratops ornatus*, type, one twelfth natural size. A, side view; B, dorsal view of crest.

Plate XXX. Skull of *Anchiceratops ornatus*, type, one twelfth natural size. A, ventral view of crest; B, anterior view, postfrontal fontanelles showing through supratemporal fenestræ.

Plate XXXI. *Anchiceratops ornatus*, paratype, front view, one seventh natural size.

Plate XXXII. *Anchiceratops ornatus*, paratype, side view, one seventh natural size.

Plate XXXIII. *Anchiceratops ornatus*, paratype, occipital view, one third natural size.

Plate XXXIV. *Anchiceratops ornatus*, brain cast of paratype, nearly three fourths natural size. A, dorsal view; B, right side.

Plate XXXV. *Anchiceratops ornatus*, brain cast of paratype, nearly three fourths natural size. A, oblique side view; B, ventral view.

Plate XXXVI. Trachodont brain-case, No. 5236, incomplete, two thirds natural size. Right half, outside and inside views.

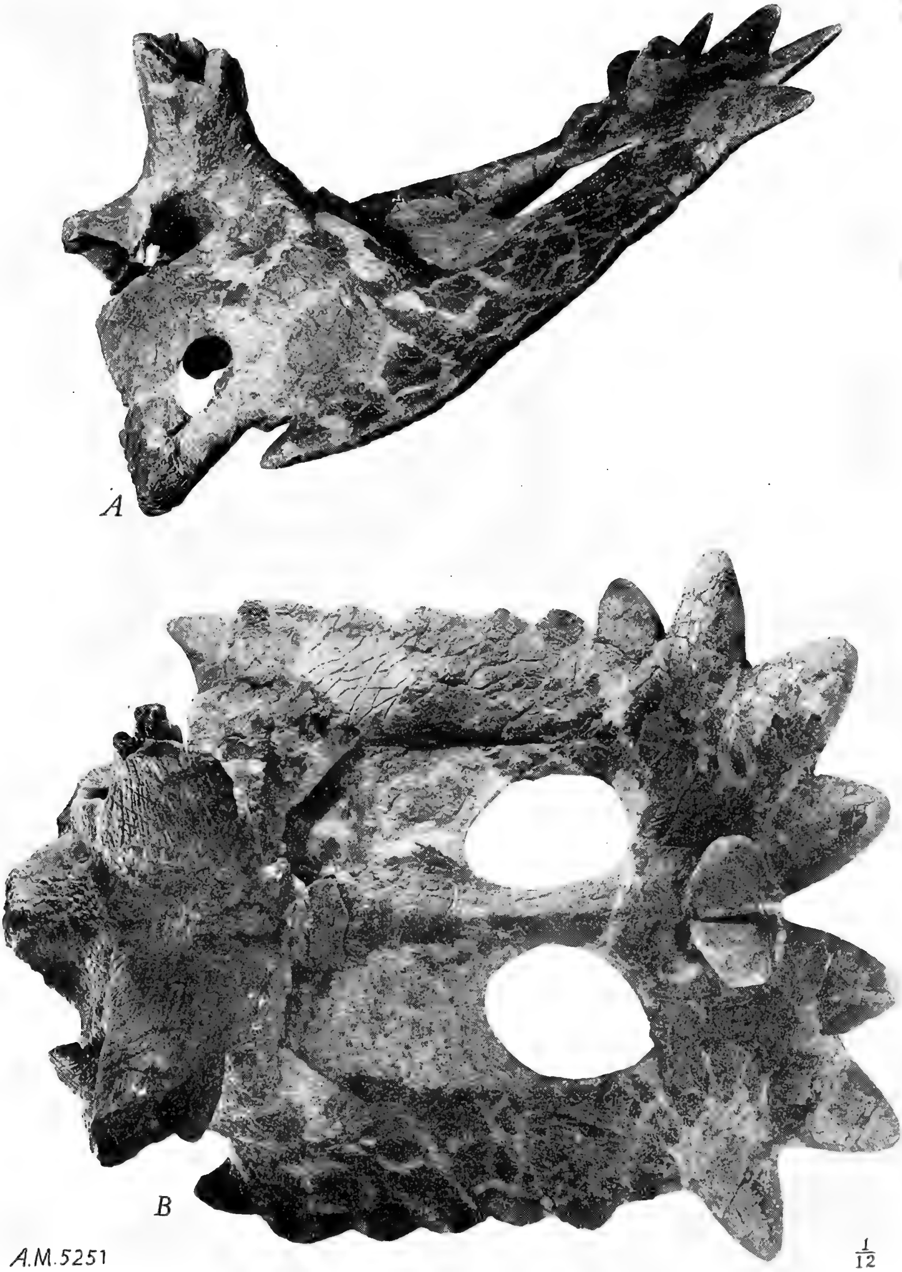
Plate XXXVII. Trachodont brain cast, No. 5236, incomplete, three fourths natural size. A, dorsal view; B, side view; C, ventral view.

Abbreviations, Plates XXXIII–XXXVII.

a.c.f., anterior condyloid foramen.
Al.sp., alisphenoid.
a.s.c., ascending semicircular canal.
B.oc., basioccipital.
B.sp., basisphenoid.
car., entrance of carotid artery into pituitary fossa.
Cbl., cerebellum.
cbl.p., process of cerebellum.
cer., cerebrum.
Cer.p., process of cerebrum.
Ex.oc., exoccipital.
f.o., fenestra ovalis.
f.r., fenestra rotunda.
h.s.c., horizontal semicircular canal.
j.v., passage of jugular vein.
med., medulla oblongata.
op.a., ophthalmic branch of internal carotid artery.
Pa., parietal.
pit., pituitary body.
p.s.c., posterior semicircular canal.
Pr.ot., proötic.
S.oc., supraoccipital.
*, veins and diverticulæ.

Cerebral nerves.

I, olfactorii.
II, optici.
III, motores oculorum.
IV, pathetici.
V, trigemini.
VI, abducentes.
VII, faciales.
VIII, auditorii.
IX, glossopharyngei.
X, pneumogastrici.
XI, accessorii.
XII, hypoglossi.



ANCHICERATOPS ORNATUS. Type.

ANCHICERATOPS ORNATUS. Type.

A.M. 5259

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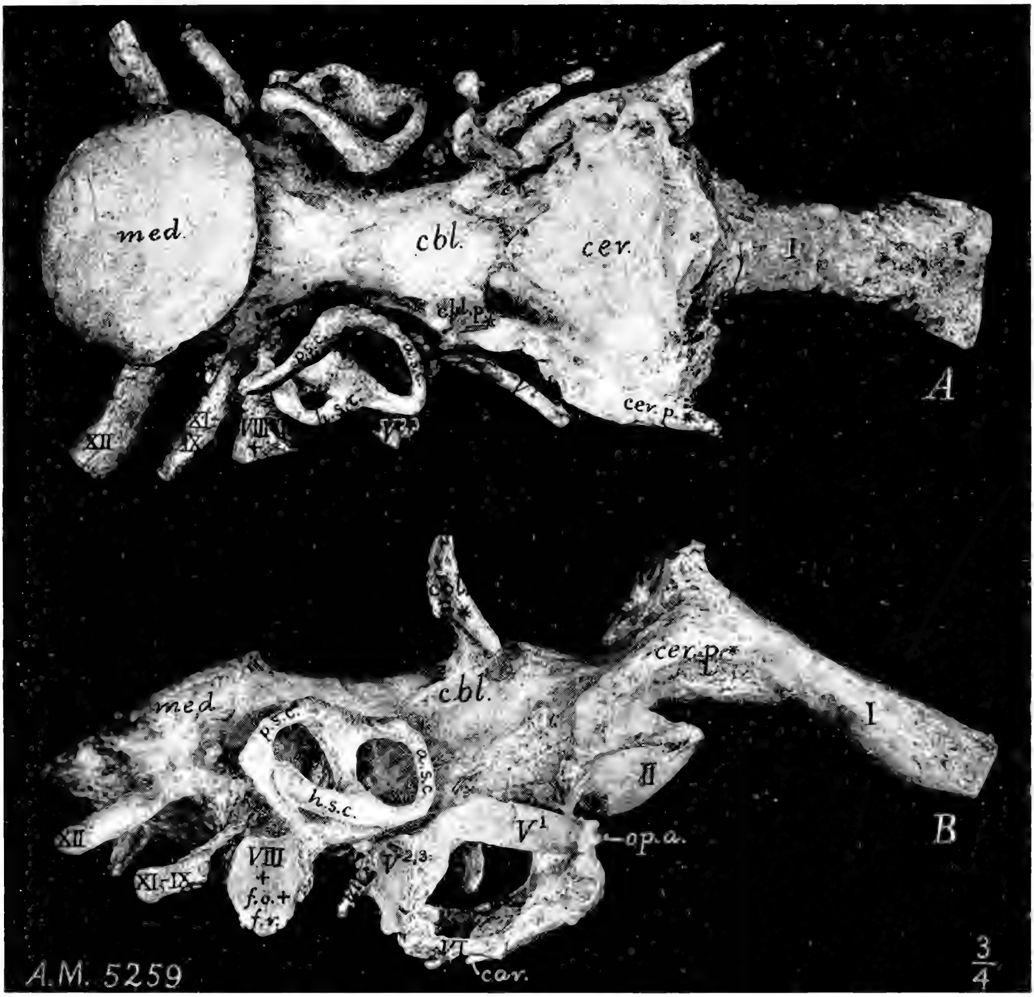
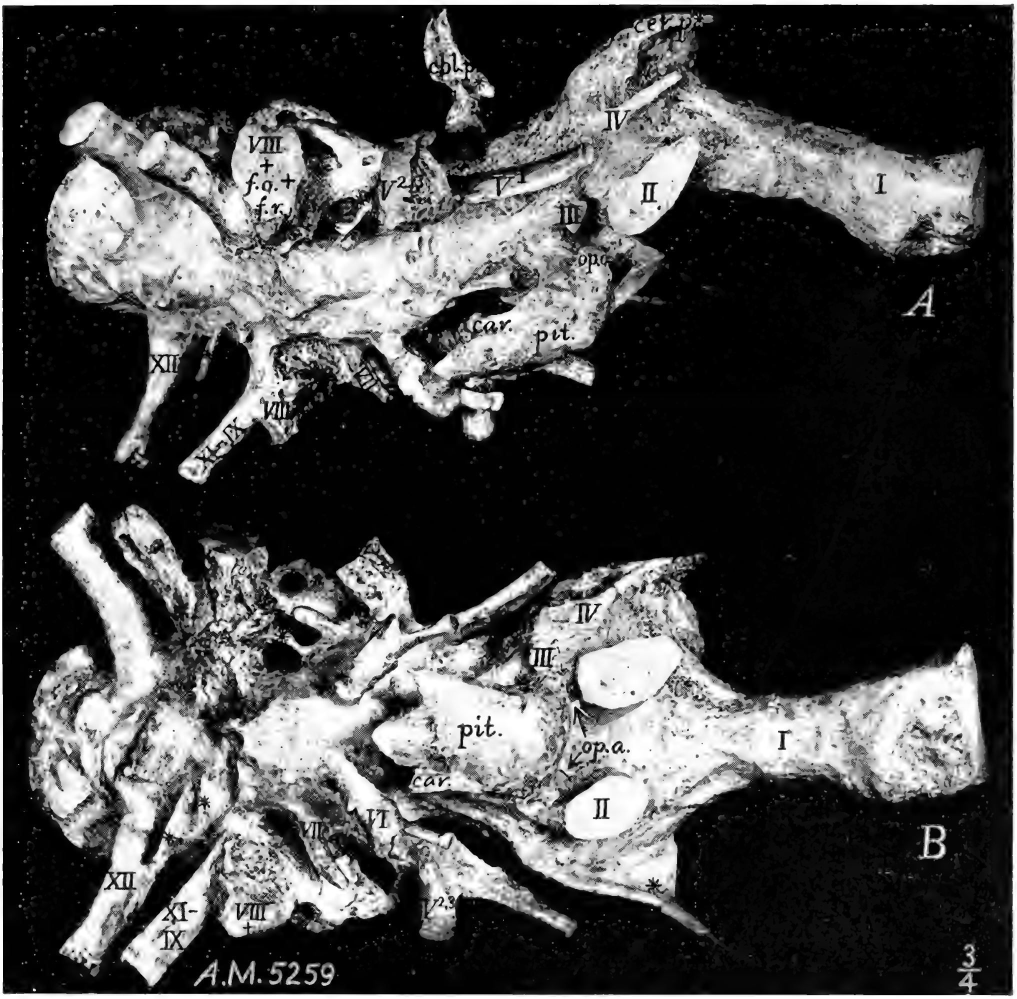
ANCHICERATOPS ORNATUS. Paratype.

Anchiceratops ornatus. Paratype.

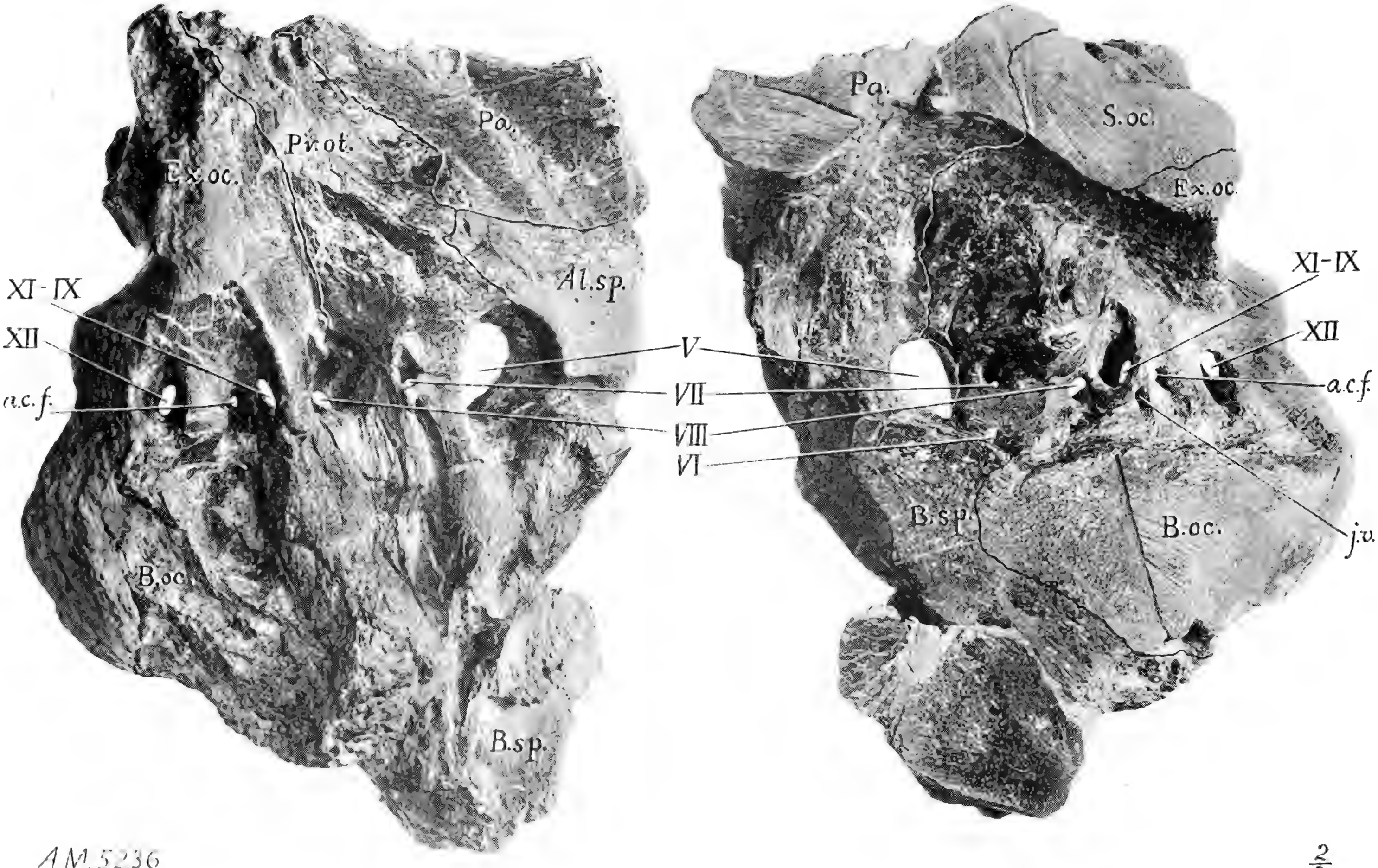
Anchiceratops ornatus. Paratype.



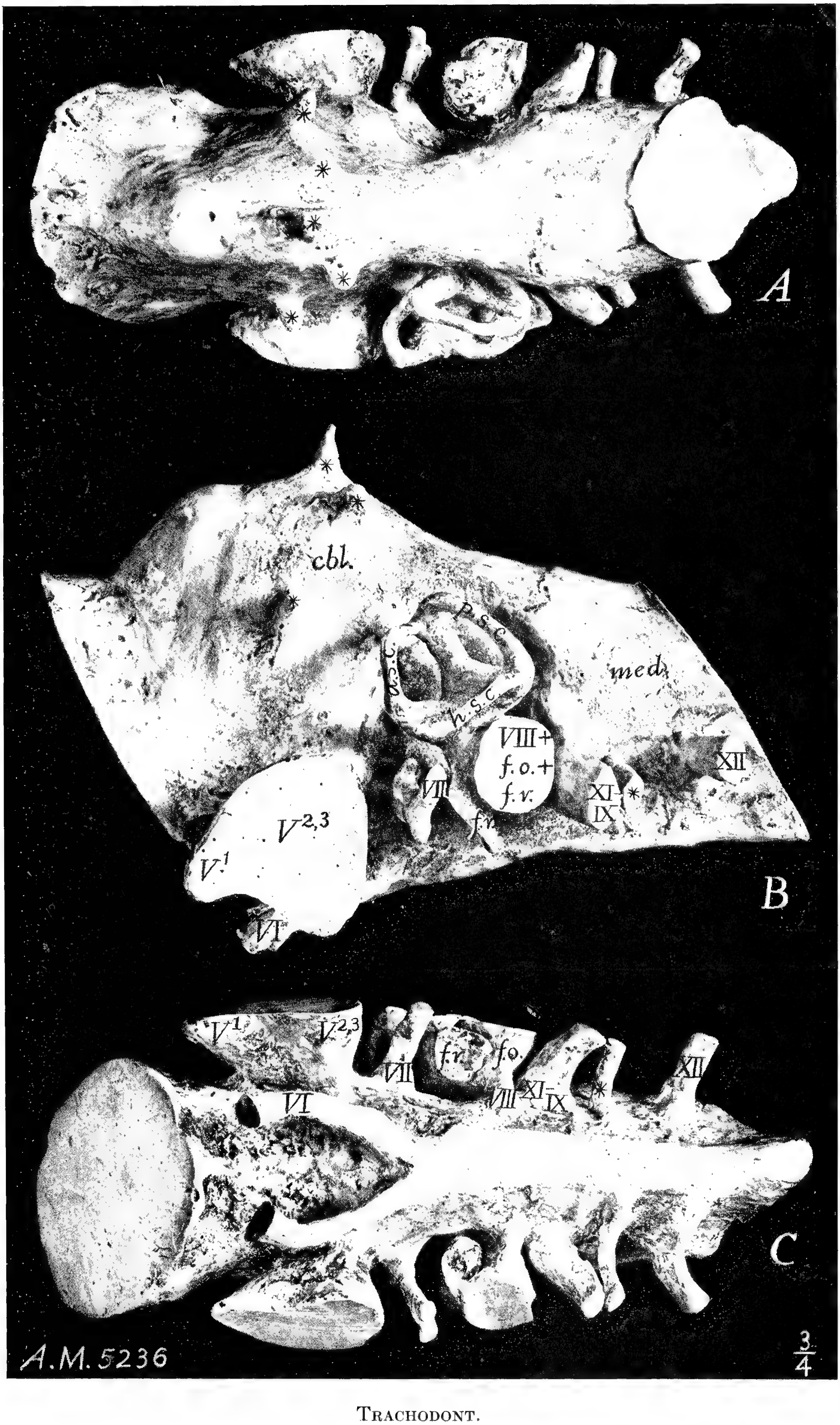
ANCHICERATOPS ORNATUS.



ANCHICERATOPS ORNATUS.


Pa.
Pr.ot.
Ex.oc.
Al.sp.
XI-IX
XII
a.c.f.
B.oc.
B.sp.
V
VII
VIII
VI
Pa.
S.oc.
Ex.oc.
XI-IX
XII
a.c.f.
B.sp.
B.oc.
j.v.
A.M.5236
2/3

TRACHODONT.


A
cbl.
p.s.c.
a.s.c.
h.s.c.
med.
VIII+
f.o.+
f.v.
VII
fr.
XI-
IX
XII
$V^{2,3}$
V^1
VI
B
V^1
$V^{2,3}$
VII
fr.
fo.
VIII
XI-
IX
XII
VI
C
A.M. 5236
3/4

Trachodont.

56.81.9m(117:71.2)

Article XXXIV.— A COMPLETE SKULL OF *MONOCLONIUS*, FROM THE BELLY RIVER CRETACEOUS OF ALBERTA.

BY BARNUM BROWN.

PLATES XXXVIII–XL.

A rare specimen secured by the American Museum Expedition of 1912 is a complete skull of *Monoclonius* from the Judith River (Belly River) exposures on the Red Deer River, one mile below the mouth of Berry Creek. It is unusually perfect, lacking only the vomers, and the sutures are for the most part still well defined, a condition that enables us to understand more clearly the structure of the primitive Ceratopsian skull. Compared with other known skull material it shows the range of variation in horns, and in the peculiar outgrowths on the back of the crest in this genus.

In order to clear up some of the synonymy of related forms it will be necessary to review briefly the work of previous writers.

The genus *Monoclonius* was established by Cope (Proc. Acad. Nat. Sci. Phila., Vol. XXVIII, pp. 255–256, 1876), the type of the genus being *M. crassus* which includes parts of the skeleton and the posterior crest of a skull.

In 1889 Cope (Am. Nat., Vol. XXIII, p. 716) briefly described and gave the name *M. recurvicornis* to another skull that had previously (Bull. U. S. Geological and Geographical Survey of the Territories, Vol. III, pp. 588–594) been described in detail but without name. In the same paper (pp. 716–717) a nasal horn and premaxillary were described to which he gave the name *M. sphenocerus*.

A fourth species *M. fissus* (*ibid.*, p. 717) was at this time proposed for a pterygoid which he identified as a squamosal.

The types of these four species were all collected from the Judith River beds of Montana and now form a part of the collection of the American Museum.

In a Monograph of the Ceratopsia Hatcher (Monograph 49 of the U. S. Geological Survey, Vol. XLIX, p. 81, 1907) rightly regards the species *M. fissus* as a *nomen nudum*, for the specimen is neither generically nor specifically determinable. Hatcher (*ibid.*, p. 87) was also probably right in transferring *M. recurvicornis* to the genus *Ceratops* Marsh.

With the knowledge of the complete skull herein described a comparison of the types of *M. crassus* and *M. sphenocerus* leaves little doubt that they

are specifically identical, in which case *M. sphenocerus* becomes a synonym of *M. crassus.* This leaves only one identifiable species of the genus from the Judith River beds of Montana, *M. crassus,* although future discoveries will probably disclose as great a variety of horned dinosaurs there as further north in Canada.

From the Belly River beds exposed on the Red Deer River, Alberta, Lambe (Contributions to Canadian Palæontology, Vol. III (quarto), Part II, 1902) obtained and described three species of the genus *Monoclonius, M. dawsoni, M. canadensis* and *M. belli.* The second and third of these, *M. canadensis* and *M. belli,* have been removed by Hatcher to the genus *Ceratops.* The first species, *M. dawsoni,* was founded on two imperfect skulls (No. 1173 and No. 971 Coll. Can. Geol. Surv.). No. 1173, of which a sketch was made in the field before the bones were removed, is figured on page 58 (Fig. 14) (*loc. cit.*) and includes some of the bones surrounding the orbits, the right maxilla, a quadrate, the occipital condyle, a part of the posterior crest, fragments of the frontal-nasal bones and a curved horn. The second specimen (No. 971 Coll. Can. Geol. Sur.) on which this species was founded is a complete posterior part of a crest with which there was a separate pointed bone, thought to be a horn.

After examining this material Hatcher (*loc. cit.,* pp. 91–92) says: "I am inclined to regard the present species (*M. dawsoni* No. 1173) as closely allied to if not identical with the *M. crassus* of Cope . . . . The peculiar parietal (No. 971) associated by Lambe with the type of *M. dawsoni* I regard as pertaining to a distinct species and perhaps also to a distinct genus." In his conclusion as to the separation of this material Hatcher was influenced chiefly through consideration of the supposed horn, which he discusses at some length (*loc. cit.,* p. 93). Mainly due to Hatcher's suggestion (*loc. cit.,* foot note p. 93) Lambe (Ottawa Naturalist, Vol. XVIII, No. 4, pp. 81–83, pl. i, 1904) redescribed the specimen No. 971 and proposed for it the new generic and specific name *Centrosaurus apertus,* basing the generic distinction solely on the peculiar hook like processes of the postfrontals (parietals) and the supposed nasal horn. This supposed nasal horn was later found to be a process of the crest and to extend diagonally forward above the right fontanelle and the specimen was refigured with it in place (Lambe, Ottawa Naturalist, Vol. XXIV, pp. 149–151, pl. iii, 1910).

Through the courtesy of Mr. Lambe I have been able to examine the types of *M. dawsoni* and *Centrosaurus apertus.* Although the greater part of the nasal is missing in No. 1173 there is a portion of the anterior upper border of the nares present as well as the tip of the premaxillary, demonstrating conclusively that the nasal horn curves backward as Mr. Lambe described it. With the complete skull as a guide I can see no characters that distinguish

Centrosaurus apertus from *M. dawsoni* and consider the former a synonym of the latter.

This leads us to consider the new, complete skull of *Monoclonius* from Canada which is specifically different from *M. crassus* and *M. dawsoni* (*Centrosaurus apertus*).

Monoclonius *Cope.*

Generic characters: Skull small to medium sized with three horns; nasal horn large, curved or straight, rising from middle of nasals immediately above the posterior border of the nares; supraorbital horns small or incipient and flattened on the outer surface. Nasals large; nares nearly separated by osseous septum formed by premaxillaries and nasals. Premaxillaries deep with vertical plate forming septum non-fenestrated. Crest composed of short, broad squamosals and extension of elongate coössified postfrontals ('parietals') perforated by large fenestræ; each fenestra wholly within the boundary of the postfrontal. Margin of crest crenulated, each prominence bearing a separate ossification. A pair of long curved hook-like processes on posterior border of postfrontals.

This definition differs considerably from that given by Hatcher and Lull (*loc. cit.*, p. 162), but a reëxamination of all the known material confirms it.

Monoclonius flexus sp. nov.

Specific characters: Skull medium sized. Nasal horn long and curved forward. Supraorbital horns short.

The relation of the various elements of the skull is essentially the same as in *Triceratops*, but those parts connected with the horns, the nose, and the posterior crest are greatly modified. The facial portion anterior to the orbit is comparatively longer than in any related genus and the nares are extremely deep.

Styracosaurus Lambe (Ottawa Naturalist, Vol. XXVII, No. 9, pp. 109–116, 1913) seems to be the closest related genus and the elements of the skull are similarly developed but in *Styracosaurus* the entire facial portion appears to be shorter, the nasal back of the horn is short, squamosal shorter, postfrontal (parietal) fontanelles reduced, epoccipital bones extremely long and posterior hooks of crest absent.

In profile (Plates XXXVIII and XXXIX) the most prominent feature is the nasal horn, which curves forward and is longer than in any described species of the family. Apparently it was derived from one center of ossification. It is ovate in cross section at the base, with the broad end of the oval posterior, and gradually tapers to a sharp terminal point. It rises from the nasals in midline antero-posteriorly and its center is directly above the

posterior border of the nares. This is a marked departure from *Triceratops* where in all species the nasal horn rises from the extreme anterior end of the nasals and the opening of the nares extends far back. In *M. crassus* (*sphenocerus*) the nasal horn is thin transversely, a character accentuated by crushing, erect and vertical to the nasals. In *M. dawsoni* the nasal horn is nearly as long as in the present species and it has the same degree of curvature but in the opposite direction.

The supraorbital horns are considerably larger than in *M. dawsoni*, and in this specimen they are asymmetrical, that of the left side being higher than the right. They are compressed laterally and very rugose, especially on the inner side. If the points of the supraorbital horns were derived from separate centers of ossification it is quite possible that the one from the right side has been lost and we have here only the rugose elevated portion of the postfrontal forming its base of attachment. Hatcher states (*loc. cit.*, p. 33), that the nasal horn, like the rostral, predentary, epoccipitals and epijugals may be considered dermal or epidermal ossifications, that they "differ greatly from the supraorbital horn cores, which are simple outgrowths of the postfrontals, and therefore are morphologically a part of their supporting elements." Whether or not they were sheathed in horn in this rudimentary stage is doubtful.

Anteriorly the rostral is developed the same as in *Triceratops* but the anterior ascending process is not carried upward as far.

The premaxillaries unite anteriorly to form a broad smooth vertical plate-like septum more nearly separating the nares than in *M. crassus* (*sphenocerus*) and non-fenestrated, whereas in all species of *Triceratops* this portion is fenestrated. In front they are convex and swelled out forming the front of the nose. Each sends upward a process reaching nearly to the base of the nasal horn, which is overlapped by a descending process of the nasals. Posteriorly each unites with the maxillary, lacrymal and nasal.

The nasals are much longer and larger than in *Triceratops* and quite different in form. Posterior to the nasal horn they have early united and all trace of union is obliterated; they form the top and sides of the nose back half-way between the nasal and supraorbital horns, where they unite with the frontals on the top, with the lacrymal and preorbitals on the sides, and with the premaxillaries below. Anterior to the nasal horn they are separated by the ascending processes of the premaxillaries and each sends downward a short plate that unites with the vertical plate of premaxillaries forming the septum. In *Triceratops* no portion of the osseous septum is formed by the nasals.

The maxillary has the same form as in *Triceratops* and as in that genus unites on the side with premaxillary, lacrymal and jugal, below with the premaxillary, palatine, epipterygoid and pterygoid.

The orbit is large and circular with the vertical slightly greater than the anteroposterior diameter. Its borders are rugose and formed by the lacrymal, preorbital, prefrontal, postfrontal, squamosal and jugal.

The jugal, as in *Triceratops*, unites above with the lacrymal, maxillary and squamosal but the quadratic portion is much more extensive than in that genus. The laterotemporal fenestra is entirely surrounded by the squamosal and the jugal. The posterior process of the jugal which forms its lower border overlaps the quadrato-jugal and quadrate whereas in *Triceratops* the quadrato-jugal forms the lower border of the laterotemporal fenestra and more of it is exposed on the side. The epijugals are missing in this specimen.

The posterior crest (text Figs. 1 and 2 and Plate XL) is composed of three bones, the two lateral squamosals suturally distinct, and the postfrontals (parietals) coössified into a single element. (For interpretation of cranial elements see recent description of *Anchiceratops* (Brown, Bull. Am. Mus. Nat. Hist., Vol. XXXIII, pp. 539–548, 1914. It is broader transversely than long anteroposteriorly and saddle-shaped with a large fontanelle or opening on either side of the longitudinal axis, margins crenulated with distinct epoccipital bones on the prominences, that increase in size toward the posterior margin, the last prominence on each side a long hooked process.

This crest, with the exception of the process across the fontanelle, is similar in form to the specimen (No. 971 Coll. Can. Geol. Surv.) discovered by Lambe in the same locality and described first as *M. dawsoni* and later as the type of a new genus and species *Centrosaurus apertus* (Ottawa Naturalist, Vol. XVIII, No. 4, pp. 81–83, pl. i, 1904, and *ibid.* Vol. XXIV, pp. 149–151, pl. iii, 1910).

The squamosal is a thin irregular quadrilateral plate whose greatest length is oblique to the longitudinal axis of the skull. Anteriorly and above it unites with the postfrontal, postorbital and jugal and sends forward and downward a short process to unite with the posterior process of the jugal and form the lower border of the laterotemporal fenestra. On the free anterior border there is a deep emargination posterior to the quadrate followed by four projections on the right and five on the left squamosal. On the right side there are two separate epoccipitals and the base of a fourth. The upper border unites along its entire length with the postfrontal and forms a part of the border of the supratemporal fenestra.

The posterior two-thirds of the crest is formed by the broadly expanded postfrontals (parietals) coössified to form a single element, perforated on each side by a large fontanelle. This portion has been somewhat distorted through pressure. Between the supratemporal fenestra the postfrontals divide sending forward a bar on each side which expands in front of the post-temporal fossa to form the roof of the skull between the supraorbital horns.

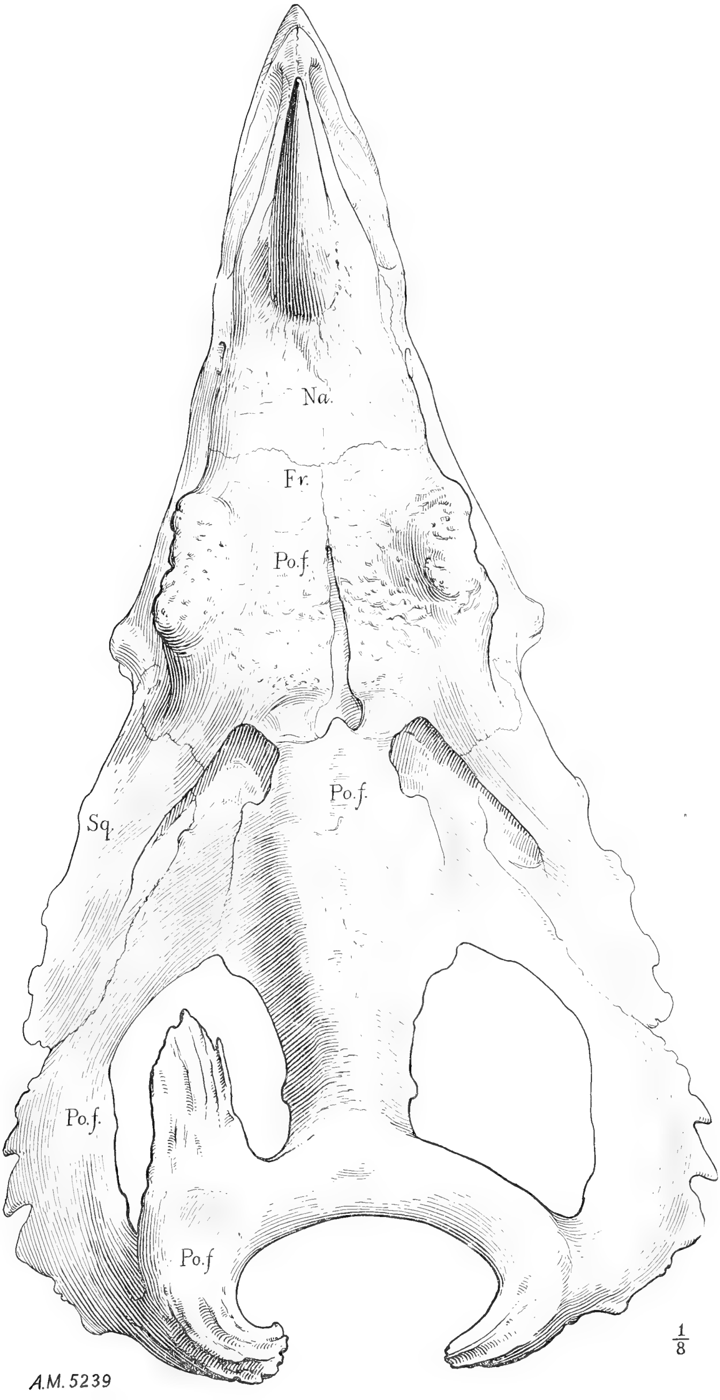


Fig. 1. *Monoclonius flexus*, top view, one eighth natural size. Type, No. 5239.

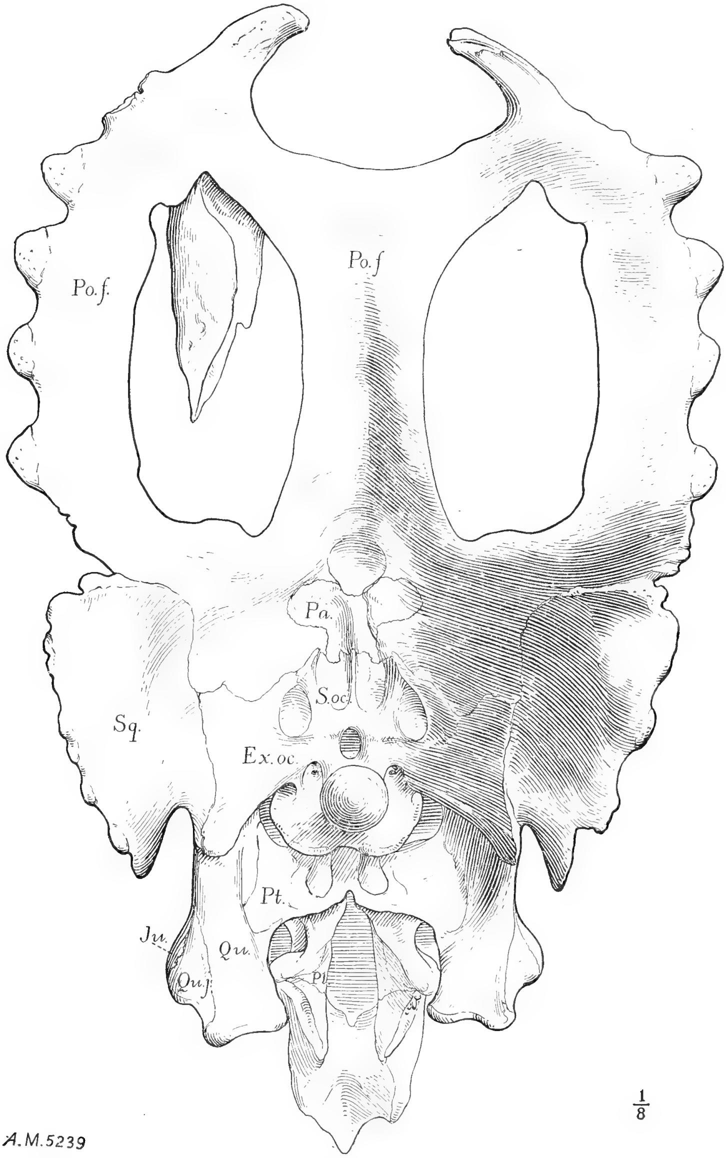


Fig. 2. *Monoclonius flexus*, occipital view parallel with spinal cord, one eighth natural size. Type, No. 5239.

In this specimen the two expanded portions do not touch in the middle and the border of the fossa is carried forward almost to the frontals. Between the posttemporal fossa and the supratemporal fenestra the bar portion of the postfrontals is smooth and set below the plane of the rugose surfaces in front and behind. Over this bar blood-vessels probably passed into the fossa supplying nourishment to the base of the horns but the fossa is distinct from the supratemporal fenestra and does not communicate with the brain cavity. The postfrontal is a continuous bone from the base of the supraorbital horns to the posterior end of the skull.

The central portion is a convex longitudinal bar which continues back on the same plane with the face but is elevated at the posterior end where it sends off on each side a stout lateral bar which continues outward then forward and inward to join the central portion completely enclosing the large fontanelles. The longitudinal bar increases in thickness toward the posterior end and the lateral bars are about 6 cm. thick. From the lateral bar on the left, a large process extends forward above the fontanelle of that side. On the right side it is absent. In one specimen of *M. dawsoni* (*Centrosaurus apertus*), No. 971 Coll. Can. Geol. Surv., there is a similar process on the right side but none on the left. This process is an irregular mass of bone on the upper surface of which there are seven parallel longitudinal ridges. Morphologically it is similar to the tendon bones and was probably the posterior attachment of the large temporal muscles which passed forward and down through the supratemporal fenestra.

The free lateral border of the postfrontal is crenulated like the squamosal and the projections are surmounted by epoccipital bones which increase in size toward the posterior end. On the right side the first and last are missing and on the left side the last is missing.

In the Monograph on the Ceratopsia by Hatcher and Lull (*loc. cit.*, p. 162), it is stated that in *Monoclonius* "The margin of the crest is crenulated but the prominences do not seem to have arisen from separate ossifications, as in the succeeding genera of this phylum." Now the type of *M. crassus* is the posterior half of a crest or frill of an old individual, and it had evidently been subjected to considerable abrasion during fossilization so that the sutural borders of the epoccipitals are indistinct. Moreover, the two posterior prominences, one on either side of the central concave border, are the remains of the posterior hook-like processes complete on the type of *M. dawsoni* (*Centrosaurus apertus*) and on the present specimen.

These hook-like processes are in structure exactly like the process that overlies the postfrontal fontanelle and clearly different from the horn cores although they may have had the same morphological origin. The horn cores are composed of open cellular tissue while these processes are

made up of dense fibers separated by long canals and clearly analogous to the tendon bones that are present along the vertebral column of most dinosaurs. In fact they resemble a compact bundle of tendon bones fused together and were possibly the attachment of those muscles used chiefly in the vertical movement of the skull.

The occipital region is similar to that of *Triceratops* and the bones composing it have the same relation and proportional size. A part of the sutures only are well defined. Those below the condyle and the exoccipitals are distinct.

From the superior border of the foramen magnum a ridge passes diagonally downward and outward marking the line of contact of the exoccipitals and supraoccipitals as in *Triceratops* and on each side of the foramen magnum there is a large round shallow depression wholly within the supraoccipital. The suture marking the upper border of the supraoccipital is clearly defined on the left side, where it is separated from the postfrontals. The line of separation between it and the parietals is indicated but not well defined. Above the foramen magnum and within the boundary of the supraoccipital and parietal there is an extensive shallow depression divided by a high sharp vertical ridge slightly swollen near the middle. A line drawn transversely through this swollen part marks the lower border of the parietal. The upper border of the parietal is not distinct but is indicated by the low protuberance on either side of the central ridge. Above the parietal the postfrontal continues to the posterior border of the crest first as a wide overhanging roof but near the end becoming thick and narrow.

The structure of the palate is similar to that of *Triceratops* with little apparent difference in form or relation of its elements. The rostral is V-shaped, the angle prolonged below to form the sharp beak with lateral bars overlapping the premaxillaries, which in this individual are separated along the median line by a space one inch wide. The maxillaries are united anteriorly to form the roof of the mouth, and at the posterior end of this union are notched for articulation with the anterior end of the vomers, missing in this specimen but which were evidently small and rod-like. The vomers formed a long narrow bridge dividing the space between the maxillaries into two large vacuities as in *Triceratops*. The palatines and pterygoids are like those of *Triceratops*. The teeth are not distinguishable from those of *Triceratops*. In the upper jaw there were about thirty-five vertical series of teeth but the number cannot be accurately determined in this specimen. They follow the normal Ceratopsian method of development and implantation.

To recapitulate briefly the three species of *Monoclonius* now recognized are determined as follows:

M. crassus. Skull medium sized. Nasal horn straight and vertical. Supraorbital horns small. Judith River Cretaceous.

M. dawsoni. Skull medium sized. Nasal horn curved backward. Supraorbital horns rudimentary. Belly River Cretaceous.

M. flexus. Skull medium sized. Nasal horn curved forward. Supraorbital horns small. Belly River Cretaceous.

Measurements.

	mm.
Total length of skull, approximately, along facial angle	1570
Length between condyle and anterior end of rostral	840
" of nasals	420
Width between orbits	290
Greatest width of crest between borders of squamosals, over top	1130
Height of skull between posterior end of nasals and border of alveolus	360
Extreme height of nasal horn from top of nasals, anteriorly	330
Circumference of nasal horn at base	370
Height of supraorbital horn above top of orbit, left side	100

Abbreviations used in illustrations of *Monoclonius* skull.

Ex.oc.	= Exoccipital.	*Po.f.*	= Postfrontal.
Fr.	= Frontal.	*Pt.*	= Pterygoid.
Ju.	= Jugal.	*Qu.*	= Quadrate.
Na.	= Nasal.	*Qu.j.*	= Quadrato-jugal.
Pl.	= Palatine.	*S.oc.*	= Supraoccipital.
Pa.	= Parietal.	*Sq.*	= Squamosal.

EXPLANATION OF PLATES.

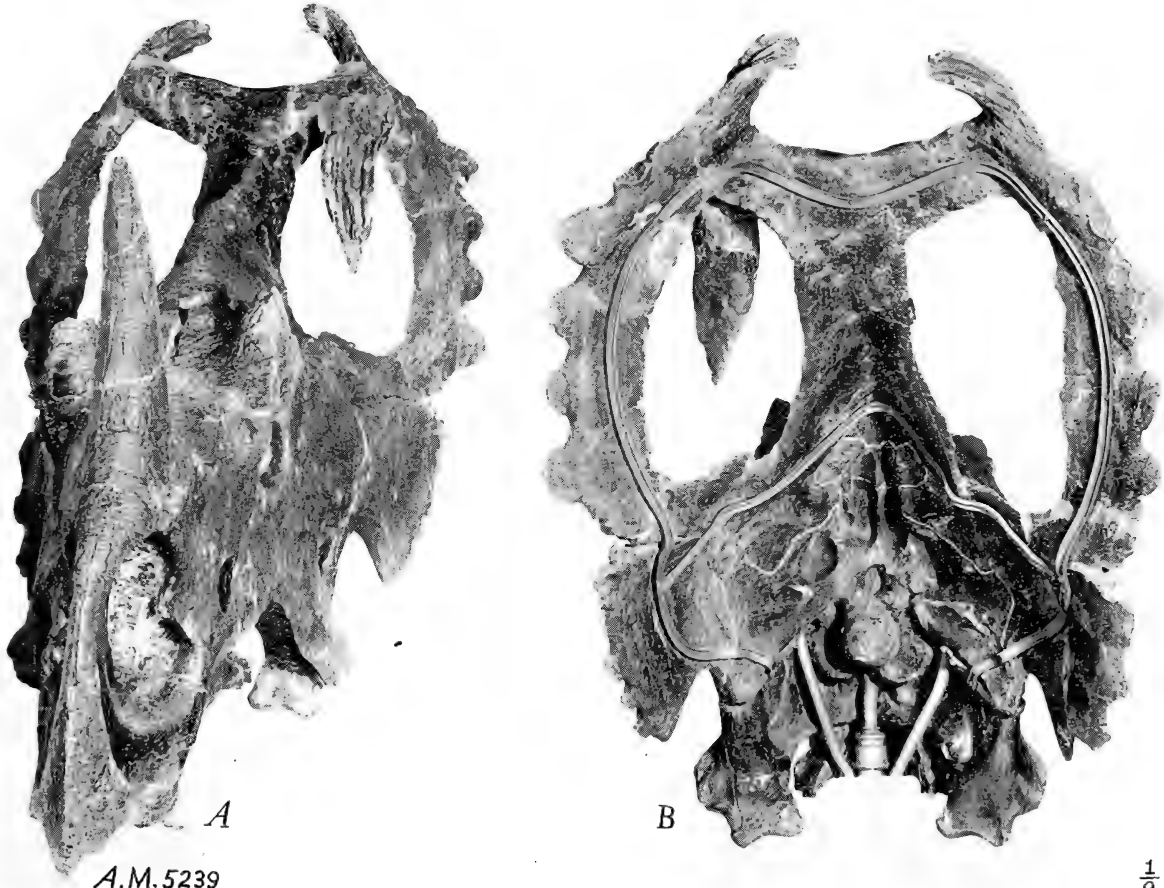
Plate XXXVIII. *Monoclonius flexus*, left side, one ninth natural size. Type, No. 5239.

Plate XXXIX. *Monoclonius flexus*, right side, one ninth natural size. No. 5239.

Plate XL. *Monoclonius flexus*, *A* three quarters front view, *B*, occipital view, one ninth natural size. Type, No. 5239.

Monoclonius flexus. Type.

MONOCLONIUS FLEXUS. Type.



Monoclonius flexus. Type.

56.81,9C(117:71.2)

Article XXXV.— *CORYTHOSAURUS CASUARIUS*, A NEW CRESTED DINOSAUR FROM THE BELLY RIVER CRETACEOUS, WITH PROVISIONAL CLASSIFICATION OF THE FAMILY TRACHODONTIDÆ.

By Barnum Brown.

Plate XLI.

The type of this genus and species is an unusually complete skeleton, No. 5240, secured by the American Museum Expedition of 1912.

Recently Mr. Lawrence M. Lambe has described and figured in the 'Ottawa Naturalist' (April, 1914) a skull and jaws of a Trachodont from the Belly River which he refers to his *Trachodon marginatus*, 1902, and removes that species from *Trachodon* as the type of a new genus, *Stephanosaurus*. It appears probable that this skull is congeneric with *Corythosaurus casuarius*, although clearly distinct as to species. That either is congeneric with the type of *T. marginatus* is improbable. Lambe states (1914) that *T. marginatus* was based upon "a ramus of the lower jaw and a maxilla and the remains of one individual." But reference to his original description (1902) shows clearly that the last named specimen (consisting of humerus, radius, ulna and some other parts named but not figured) was regarded as type at the time of description. It is first mentioned, and the describer goes on to say that "*the species is represented further by* disassociated femora, tibiæ, metacarpals and phalanges of the manus, *rami of the lower jaw and maxillæ*, dorsal and caudal vertebræ, a pubic bone, ischia, ilia, chevron bones and numerous teeth as well as other remains *probably referable to the same species*" (italics mine). Whether the upper and lower jaws described by Mr. Lambe belonged to one individual has never been stated. The remains of the associated individual are then described and measured, and the descriptions of the femur, tibia, jaws and other referred specimens follow.

While the upper and lower jaws referred to *T. marginatus* may rank as paratypes, if they are associated, the species obviously rests primarily upon the "remains of one individual." The other specimens referred are not cotypes, and the author is not at liberty to select any of them as a lectotype to the exclusion of his primary type. If the latter be indeterminate, valid generic characters may be drawn from the paratypes, and if they also are indeterminate, then from other specimens subsequently referred.

Whether valid generic characters can be found in either the type or para-

types of Lambe's species is at present an unsettled question. There are several genera of Trachodonts in the Belly River formation clearly distinct as to skull, but not at present distinguishable in the form of lower jaw, maxilla or teeth. Good generic characters may be found in these parts or in the proportions and characters of the fore limb bones, etc., of the type. Unfortunately our skeleton has only fragments of the fore limbs preserved, insufficient for comparison with the type of *T. marginatus*, the genotype of *Stephanosaurus*.

In the measurements given for the type of *T. marginatus* the humerus is longer than the radius, a character that agrees with the genus *Trachodon*.

The lower jaw is said to measure 630 millimeters in length and the figure shows that he refers to the dentary alone. If the data are correct this dentary is 130 millimeters longer than that of the new American Museum skull herein described and 155 millimeters longer than the new Ottawa skull. In size and general form it, as well as the maxilla, agrees with the genus *Trachodon* and Lambe's original reference to that genus was probably correct.

In view of the several uncertainties thus indicated it appears inadvisable to refer the species here described to *Stephanosaurus* unless some or all of the doubtful points can be settled by further study and comparison of more associated material from the Belly River formation.

[It is regrettable that Mr. Lambe did not base his new genus upon the new and complete specimens, and leave for later study the question whether its type species was or was not identical with *Trachodon marginatus*.]

Corythosaurus casuarius gen. et sp. nov.

Type of genus and species, No. 5240, a nearly complete skeleton with integument.

Horizon and locality. Belly River Beds, 300 feet below top of formation, near Steveville, Red Deer River, Alberta, Canada.

Generic and specific characters. Skull comparatively short with a high helmet-like crest formed by nasals, prefrontals and frontals. Nasals not separated in front by premaxillaries. Beak narrow, expanded part in front of nares elongate. Narial opening small.

The skeleton is articulated and complete with exception of about two feet of the end of the tail, and the fore limbs. Both scapulæ and coracoids are in position but the rest of the fore limbs have weathered out and are represented by phalanges and pieces of humeri, ulnæ and radii, apparently incomplete.

The impression of the integument covers over the greater part of the skeleton outlining the form of the body. On the left or under side, this skin is preserved in carbonaceous clay difficult to prepare, so the work of

preparation has been slow and is not yet far enough advanced to warrant a description of the complete skeleton.

Skull. No dermal impressions were preserved on the skull and it has been entirely freed of matrix. It is compressed laterally so that the transverse width is approximately two-thirds of normal and the facial outline has been changed slightly where the nasals are pressed down upon the premaxillaries closing the nares. Otherwise the contour appears to be normal.

In proportion to the size of the skeleton the skull is much smaller and shorter than in *Trachodon, Kritosaurus* or *Saurolophus,* but on account of the enormous crest its superficial area is nearly as great.

The extraordinary crest rises above the brain-case like a Corinthian helmet or the crest of a cassowary which it resembles. It is developed from the nasals, prefrontals and frontals as in *Saurolophus* but instead of projecting backward as a heavy spine rises to the highest point in front and above the orbit. Throughout its extent the two lateral halves are separated by a median suture. In front of the orbit where it is formed by nasals and prefrontals the crest is arched in cross-section and the bone is fairly thick. Above this point the two sides approach very close, forming a vertical plate and the overlapping nasal and frontal bones are as thin as paper.

The nasal enters chiefly into the formation of the crest, extending from the tip of the beak to the highest part of the crest back of which it is overlapped by the frontal. The nasals meet in the center throughout their extent and are not separated in front by ascending premaxillary processes as in known skulls of other described genera.

The prefrontal is roughly triangular in form and is not as extensive as in the specimen described by Lambe under the name of *Stephanosaurus marginatus.* The union with the frontal is not well defined but apparently it forms no part of the orbital border.

The frontal forms the outer surface of the entire upper and posterior part of the crest overlapping the nasal for a considerable distance and extending as far forward as the anterior border of the prefrontal; posteriorly the free, thick, lower border extends above and parallel to the parietal, terminating back of the squamosals in a short, hooked process.

The mouth is comparatively narrow and the nares are small. The expanded portion of the premaxillary in front of the narial opening is elongate as in *Saurolophus* and *Trachodon,* whereas in *Kritosaurus* the nares extend far forward and the bill is short. Apparently there is no superior process of the premaxillary as in known skulls of other genera, and the nasals unite with each other to the end of the bill. In all other known skulls the nasals are separated in front by a superior process of the premaxillary. The inferior process of the premaxillary is shorter than in *Trachodon, Kritosaurus* or *Saurolophus* and does not unite with the lachrymal as in those genera.

The exact number of rows of teeth or the character of the enamel surface cannot be determined in this specimen; there are 34 rows visible in the dentary and 36 in the maxillary. The maxilla and the dentary are both short and the anterior end of the dentary is deflected as in *Kritosaurus*. The dentary of *Stephanosaurus* figured by Lambe appears to be straight as in *Trachodon*, but the form has probably been changed by crushing.

The other visible elements composing the sides and back of the skull have the same relative form and proportion but are comparatively smaller than in *Trachodon*.

A detailed description of the skeleton will be published as soon as the specimen is prepared; for the present this species may be distinguished from the skull referred to *Stephanosaurus marginatus* by the less developed prefrontal and the character of the epidermis. Lambe, in 'The Ottawa Naturalist,' Vol. XXVII, pp. 133–134, Jan., 1914, describes the skin of (*Stephanosaurus*) *marginatus* as follows: "It is with one of these specimens of last summer's collection that the skin impressions are preserved. These impressions are from the side in the trunk region, and along the tail. In the former, depressed conical plates or scales, having an oval basal outline, occur at intervals with much smaller, polygonal, tubercle-like, non-imbricating plates filling the inter-spaces. The conical plates strongly resemble limpets in shape, and are about twice their diameter apart. They reach a size of about one and a half inches in length and one and a quarter inches in breadth, with a height of about five-sixteenths of an inch. The comparatively small, intervening plates resemble the smaller sized plates of *Protorosaurus belli*, and of *Trachodon annectens*, Marsh, as described by Osborn.[1] They range in diameter from about one-eighth up to two-eighths of an inch, an increase in size occurring toward the conical plates round which the largest ones form a ring. A marked feature of the conical scales is a radial crinkling which is most pronounced at the basal circumference and extends about half way up the sloping surface."

"In the tail the same scale pattern is continued but in a less striking manner, its component parts being reduced in size. The conical plates are more nearly circular in basal outline, with a diameter of about half an inch, and a proportionately lower relief. They are relatively farther apart than those of the trunk, being about four to six times their diameter distant from each other. The polygonal ones have an average diameter of about three-sixteenths of an inch, and, as in the trunk, a slight increase in size is observed in those near the conical plates. Along the side of the body the conical plates have their long diameter in a fore and aft direction."

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[1] Memoirs of Amer. Mus. Nat. Hist., new series, Vol. I, pl. ii; integument of the Iguanodont dinosaur *Trachodon*, pls. vi and vii.

In *Corythosaurus casuarius* the tail and sides of the body are covered by polygonal tuberculate scales that vary in size in different sections, and conical limpet-like scales are not present excepting on a fold of skin back of the distal end of the tibia, which is probably a section from the belly.

Measurements.

	mm.
Complete length of lower jaw	669
Depth of lower jaw in center to alveolus	100
Complete length of skull between vertical lines	812
" " " " beak to terminal end of crest	837
Height of skull	708
Length of squamosal	300

Classification of the Trachodontidæ.

The Trachodonts seem to have been more numerous in individuals, probably also in genera and species, than any other family of Cretaceous dinosaurs, and the zenith of their development appears to have been in the Judith (Belly) River times. Their habitat was evidently in and near water and chiefly on that account skeletons are more often found intact than among shore forms.

Number of more or less complete skeletons are preserved in museums and in several specimens the epidermis is preserved with the skeleton. No doubt eventually genera and species may be determined as accurately on skeleton and skin characters as in living animals.

Many species and several genera have been proposed on insufficient and inadequate material through a lack of information as to what constitutes valid specific and generic characters. Specific characters have frequently been assigned on what is now known to be individual variation of bones or variation due to distortion of parts during fossilization. On account of the complexity of the dental apparatus, characters founded on teeth alone are quite as misleading and at present not definable without skull or associated skeletal material. The full dental series in a complete skull with jaws comprises more than two thousand teeth. The maxillary are very different from the dentary teeth and those from the end rows of upper or lower jaw are much smaller than those from the center rows and sometimes variable in form.

Our knowledge of the family has advanced so far that certain characters can be fixed as of subfamily and generic rank but the limitation of species and sexual characters is as yet problematical.

Throughout the family there is a remarkable uniformity in the shape and

muscular attachments of vertebræ, ribs and limb bones, and, excepting in a few cases, certain generic identification of separate bones is impossible. The proportionate length of limb bones appears to be constant within genera. But the critical points of distinction are the sacrum, the pelvis and the skull. The skull is of course most important and those known show a considerable variety of shapes, but here again there is a great uniformity in the form and relation of the elements composing the jaws, the side and the back of the skull. The primary type of skull appears to be that of *Trachodon*, and the various departures from this type have been brought about chiefly by modification of those elements composing the facial region.

The relationship of the Trachodonts found in New Jersey and the eastern States is not clear. The bones known are unfortunately not the most critical parts of the skeleton for definite characterization, but they do differ considerably from the well defined western genera.

Admitting *Hadrosaurus foulkii* Leidy of New Jersey as distinct, seven genera are recognized. They form two well defined subfamilies for which the names Trachodontinæ and Saurolophinæ are proposed. *Hadrosaurus*, if a valid genus, comes within the definition of the Trachodontinæ as determined by the ischium. The position of *Claosaurus* is doubtful; provisionally I have placed it in the same subfamily.

TRACHODONTIDÆ.

Subfamily Trachodontinæ. Skull without crest. Ischium terminating in blunt rounded point.

Trachodon. Skull long; mouth widely expanded; superior premaxillary processes terminating above middle of nares. Mandibular rami not strongly decurved; edentulous portion long. Radius shorter than humerus; metacarpals extremely long. Sacrum with nine coössified vertebræ; ilium elongate, not markedly curved; pubis with long expanded blade. Femur much longer than tibia.

Integument composed of non-imbricating tuberculate scales uniformly large over tail and back, differentiated into rosette-like pattern on belly.

Kritosaurus. Skull deep and massive; mouth narrow; nasals highly arched posteriorly; superior premaxillary processes extending beyond middle of nares; frontals short, orbital portion reduced barely coming to orbit. Mandibular rami massive and decurved anteriorly, edentulous portion short. Spines of anterior dorsal vertebræ high.

Integument with tuberculate scales of uniform size.

Hadrosaurus? Borders of mandibular teeth rounded, with feeble transverse ridges resolved into minute tubercles. Radius shorter than humerus. Femur longer than tibia. Metatarsals II and IV proportionately longer than in *Trachodon*, *Saurolophus* or *Claosaurus*. Ilium deep and strongly arched, anterior process long, pointed and triangular. Ischium not expanded distally.

A.M.5240

A

A.M.5240

Corythosau

B

$\frac{1}{1}$

CASUARIUS.

Corythosaurus casuarius.

Claosaurus. Mandibular teeth half as wide as high, lateral borders with transverse denticulate ridges resolved into 3 or 4 tubercles. Sacrum with seven coössified vertebræ. Ilium deep, anterior process strongly curved and triangular.

Subfamily SAUROLOPHINÆ. Skull with crest. Ischium terminating in expanded foot-like end.

Saurolophus. Skull large with long spike-like crest formed by nasals, prefrontals and frontals; mouth expanded and elongate; superior premaxillary process extending to posterior border of nares; lachrymal long. Radius and humerus of equal length. Sacrum composed of eight coössified vertebræ. Ilium strongly arched; pubis with short anteriorly expanded blade. Phalanges of digits II and IV short.

Hypacrosaurus. Cervical vertebræ strongly opisthocoelus, spines reduced or absent, ribs stout. Dorsal vertebræ with centra reduced in size, spines high and massive, five to seven times the height of respective centra. Scapula long and very broad. Radius much longer than humerus; metacarpals comparatively shorter than in *Trachodon.* Sacrum with eight vertebræ. Ilium deep and strongly arched. Ischium long with large foot-like terminal end. Pubis with anterior blade short and broadly expanded. Femur, tibia and fibula of nearly equal length. Pes long and massive.

Integument known not differentiated in pattern, tubercules small and elevated.

Corythosaurus.— Skull short with high anterior, helmet-like crest formed by nasals, prefrontals and frontals; nasals not separated in front by premaxillaries; mouth narrow, expanded part in front of nares elongate; narial opening small.

Integument composed of low polygonal non-imbricating tuberculate scales on sides, back and tail; rows of conical limpet-like scales on belly.

DESCRIPTION OF PLATE.

Plate XLI. *Corythosaurus casuarius.* *A*, oblique front view of skull, focal point at *Mx.* Nose slightly enlarged, posterior end foreshortened. *B*, side view nearly one-fourth natural size. Den., dentary; Ex.o., ex-occipital; Fr., frontal; Ju., jugal; La. lacrymal; Mx., maxillary; Na., nasal; Po.f., postfrontal; Pr., prefrontal; Pr. den., predentary; P.mx., premaxillary, Qu.; quadrate; Qu.j., quadrato-jugal; Sur., surangular; Sq., squamosal.

56.81,9L(117:71.2)

Article XXXVI.—*LEPTOCERATOPS*, A NEW GENUS OF CERATOPSIA FROM THE EDMONTON CRETACEOUS OF ALBERTA.

By Barnum Brown.

Plate XLII.

In the collection of fossils secured by the American Museum Expedition of 1910 there are two specimens that represent a diminutive Ceratopsian, about the size of *Brachyceratops montanensis* Gilmore (Smithsonian Miscellaneous Collections, Vol. LXIII, No. 3, pp. 1–10, 1914) from somewhat older beds.

Two individuals are represented by fragmentary skeletons found together with no other bones commingled so that the association is positive. One specimen is slightly larger than the other and parts of the fore limbs are duplicated. Unfortunately the greater part of both skeletons had long been weathered out in an old cow-trail and many of the large pieces of skull and pelvis so fractured that they cannot be pieced together. One specimen includes a part of the skull, the right fore limb complete, and a long series of caudal vertebræ articulated.

This is a primitive, aberrant type related to *Brachyceratops* and markedly divergent from *Triceratops* which is typical of the Ceratopsidæ. The complete skeleton will probably show characters sufficiently diverse to warrant founding a new family to include *Leptoceratops* and *Brachyceratops*.

The animal would have been not more than four feet in height, and the body was correspondingly short, with tail relatively longer than in any described genus. The skull was short, without even a vestigial nasal horn, and the lower jaws are extremely short and deep.

Leptoceratops gracilis gen. et sp. nov.

Type of genus and species, No. 5205, parts of skull and jaws, including nasals, maxillaries, portions of the orbital border, back part of crest, dentary, predentary and splenial. A series of articulated caudal vertebræ. A complete fore limb and parts of hind limbs.

Horizon and locality. Edmonton Cretaceous, Red Deer River, Alberta. Three miles above Tolman Ferry. About four hundred feet above the Pierre.

Generic and specific characters. Skeleton small. Skull short and deep, without nasal horn. Crest with a high thin sagittal ridge, posterior border of crest smooth; squamosal extending to extreme posterior border of crest. Teeth single-rooted.

Dentary massive, short and deep, with less than fifteen rows of teeth; splenial large extending to symphysis. Predentary long and narrow. Manus with digits I, II and III terminating in hoofs; carpals ossified, ulnare and radiale large. Femur straight, with fourth trochanter comparatively large. Tail long and deep, with high slender spines and long chevrons.

The various skull bones are so different from those of related genera that, in view of their fragmentary nature, it seems unwise to even sketch an outline of the skull. In all the material there is no part of a horn core nor do the adjacent parts suggest the presence of supraorbital or nasal horns.

The nasals (Fig. 1) are united by continuous deep tongue and groove suture. They are not perfectly symmetrical and are strikingly different from those of any described member of the Ceratopsia. The right nasal, which is best preserved, is contracted anteriorly and the extreme anterior end is broken but a portion of the superior border of the nares is preserved, enough to show the narial opening to have been small and far forward, as it is in the Monocloniid Ceratopsia. The position and extent of the ascending process of the premaxillary is shown just in front of the nasal suture and this contact shows the process to have been long, thin, and deep. The full length of the sutural union of the nasals is preserved, measuring 168 millimeters.

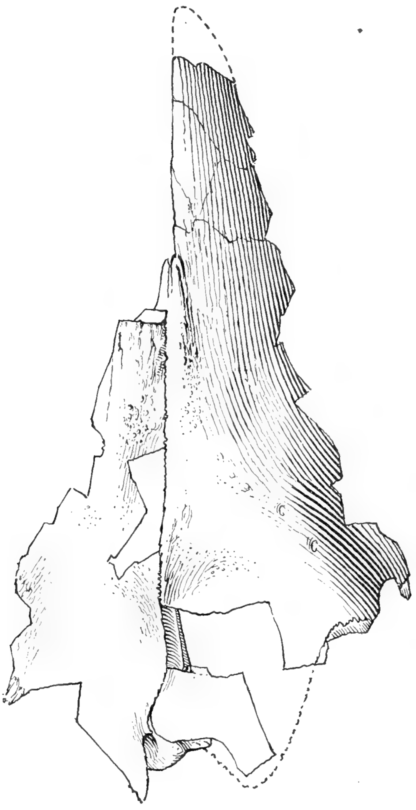

Fig. 1. Nasals, top view. *Leptoceratops gracilis*, type, No. 5205, nat. size.

The external surface of each nasal is roughened by fine rugose lines but there is not the slightest indication of an incipient horn. The internal surface is smooth with prominent longitudinal ridges marking the course of the nares superiorly. The posterior end is expanded much wider than the anterior end and a part of three sutural contacts are preserved, those of the frontal, prefrontal, and lachrymal.

The premaxillaries are not preserved but the opposing surface of the predentary shows that they were short as in *Brachyceratops.*

The maxillaries are incomplete but appear to have been shorter than in *Brachyceratops,* with less than 20 rows of teeth. In each maxillary there are several complete teeth (Fig. 2) slightly smaller than those of *Triceratops* and of similar form but the root is single whereas in other known Ceratopsian genera the roots of both maxillary and dentary teeth are bifid.

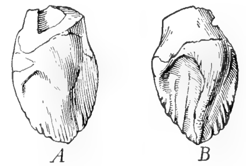

Fig. 2. Upper tooth, unworn. A, outer surface; B, inner surface. *Leptoceratops gracilis,* type, No. 5205, nat. size.

Bones of the orbital region, the palate, the jugal, and the quadrato-jugal are so broken that little can be determined of their complete form or relation to adjacent parts.

The central part of the crest or frill is strikingly different from any described form. The posterior half (Fig. 3) is a thin, comparatively flat plate with a high, central ridge on the dorsal surface. It is narrower transversely than in *Brachyceratops* and there is no indication of lateral fontanelles. The posterior border is smooth and forms a straight line at right angles to the median dorsal ridge. The more complete left half shows a part of the sutural surface for the squamosal which extended back to the extreme end of the crest. The squamosal was probably more extensive than in *Brachyceratops.*

The dentary, predentary and splenial of the right lower jaw are preserved and they differ materially from the same elements of allied genera. The jaw is shorter and deeper than in *Brachyceratops* and when oriented with the opposite side formed in cross-section a narrow V.

The predentary (Fig. 4B) shows the usual Ceratopsian form but it is relatively longer and comparatively heavier than in any described genus. The surface that opposed the premaxillary is short and narrow and the posterior process that overlapped the dentary extends back to the symphysis which is the deepest point of the jaw, under the middle of the dental series.

The dentary (Figs. 4A and 5) is unusually short and deep with a high coronoid process. The symphysis instead of reaching the end of the dentary as in *Triceratops* is confined to a narrow area below the middle of the dental series and the jaws were united chiefly by the powerful predentary. The sutural surface shows that the splenial extended as far forward as the symphysis. The broken borders of eleven alveoli are preserved and probably two more have been entirely broken off. The mandibular teeth (Fig. 6) like those of the maxillary are single-rooted. On the enamel surface there is a high median ridge and several weaker parallel ridges that corresponded to the denticles on the border of the unworn tooth.

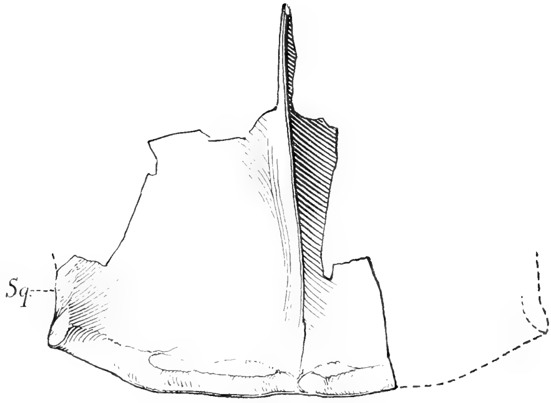

Fig. 3.

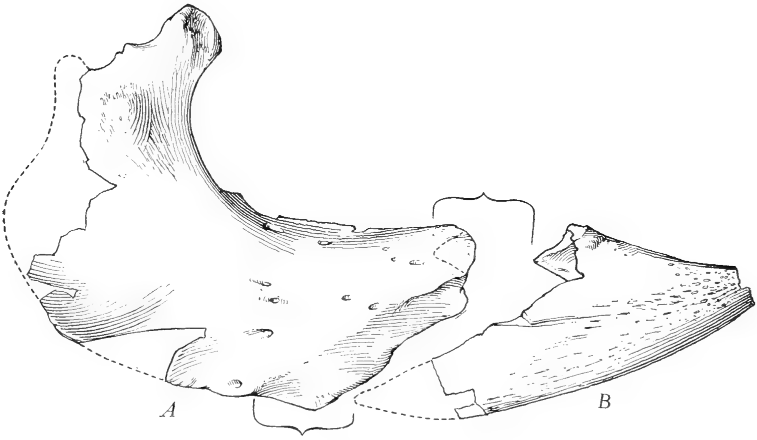

Fig. 4.

Fig. 5.

Fig. 3. Posterior end of crest; Sq., squamosal articulation. *Leptoceratops gracilis*, type, No. 5205, nat. size.

Fig. 4. Right lower jaw. A, dentary; B, predentary. *Leptoceratops gracilis*, type, No. 5205, nat. size.

Fig. 5. Right dentary, inside view. *Leptoceratops gracilis*, type, No. 5205, nat. size.

Leptoceratops gracilis. Type.

The splenial (Fig. 7) is much wider than in *Triceratops* or allied genera and extended up over a considerable part of the inner surface of the dentary.

Parts of the vertebral column are represented in both specimens, including four presacral centra, one caudal and three united sacrals of the larger individual and twenty-six caudals of the smaller specimen, twenty-four of which are articulated.

The presacral centra (Fig. 8) are short antero-posteriorly, deeply excavated on the sides and the articular faces are almost circular. Large rib facetes are present, low down on the anterior borders.

The sacral centra, probably from the posterior end of the sacrum, are long, moderately constricted and the inferior surfaces are rounded as in *Monoclonius crassus.*

The caudal series (Figs. 9 and 10) are characterized by extremely high slender spines, proportionately higher than in any described Ceratopsian, and long chevrons. The articular faces of the centra are rounded and seven bear transverse processes. In both of these specimens the spines are not thoroughly coössified to the centra. Several anterior and posterior caudals are missing and the preserved series probably represents about half of the complete tail.

The fore limb (Plate XLII) is in general structure like that of *Triceratops* with similar muscular attachments but the individual bones differ somewhat in form and are more nearly comparable to those known in *Monoclonius.*

The scapula and coracoid (Fig. 11) are curved more than in *Triceratops* or *Monoclonius* and the blade of the scapula is less expanded, long and slender.

The humerus (Fig. 12) is comparatively slender, as in *Monoclonius,* but its proximal end is less expanded and the radial crest terminates above the middle of the shaft, which is round.

The ulna (Fig. 13) differs from *Triceratops* in having a shorter olecranon process.

The radius (Fig. 14) is a round rod with expanded ends and differs very little from that of *Triceratops.* The manus (Fig. 15) is complete and at present this is the only complete fore foot known in the Ceratopsia. The bones were found practically in the position in which they are assembled. The carpals are completely ossified and distributed in two rows, a large ulnare and radiale forming the proximal row and three small irregularly rounded bones in the distal row. The latter were not in the position indicated but close by. The metacarpals are more compact than in *Triceratops* and the ends (Fig. 16) present smooth articular surfaces allowing free movement of the phalanges. In *Triceratops* the ends of the metacarpals were padded with cartilage like the Saurapoda. Terminal hoofs are present only on digits I, II, and III, and they are narrow and pointed. The phalangeal formula is 2, 3, 4, 3, 1.

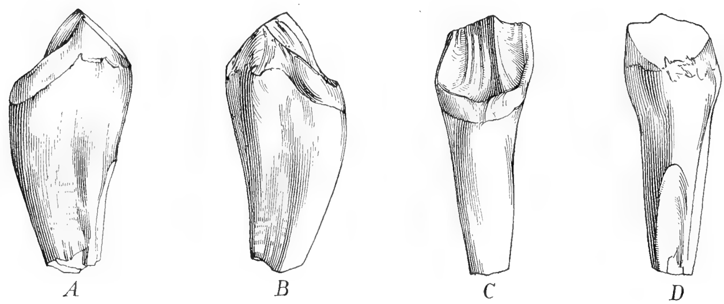

Fig. 6.

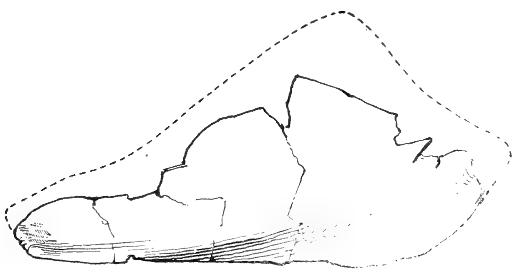

Fig. 7.

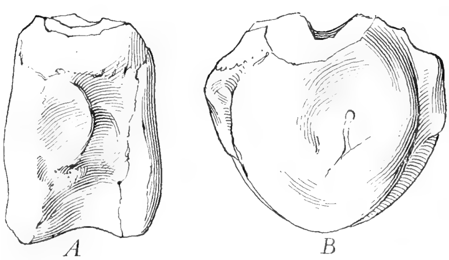

Fig. 8.

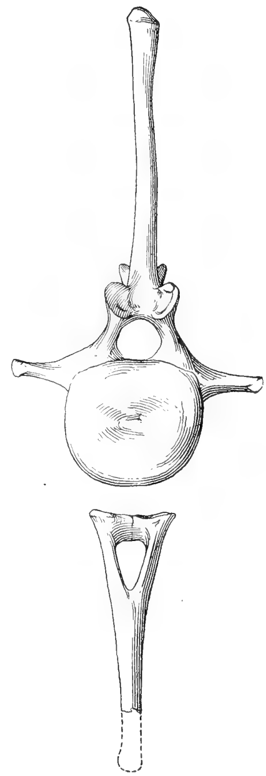

Fig. 9.

Fig. 6. Lower tooth, worn. A, anterior view; B, posterior view; C, outer view; D, inner view. *Leptoceratops gracilis*, type, No. 5205, nat. size.

Fig. 7. Splenial. *Leptoceratops gracilis*, type, No. 5205, nat. size.

Fig. 8. Presacral centrum. A, left side; B, posterior end. *Leptoceratops gracilis*, type, No. 5205, nat. size.

Fig. 9. Anterior caudal vertebra and chevron. *Leptoceratops gracilis*, type, No. 5205, nat. size.

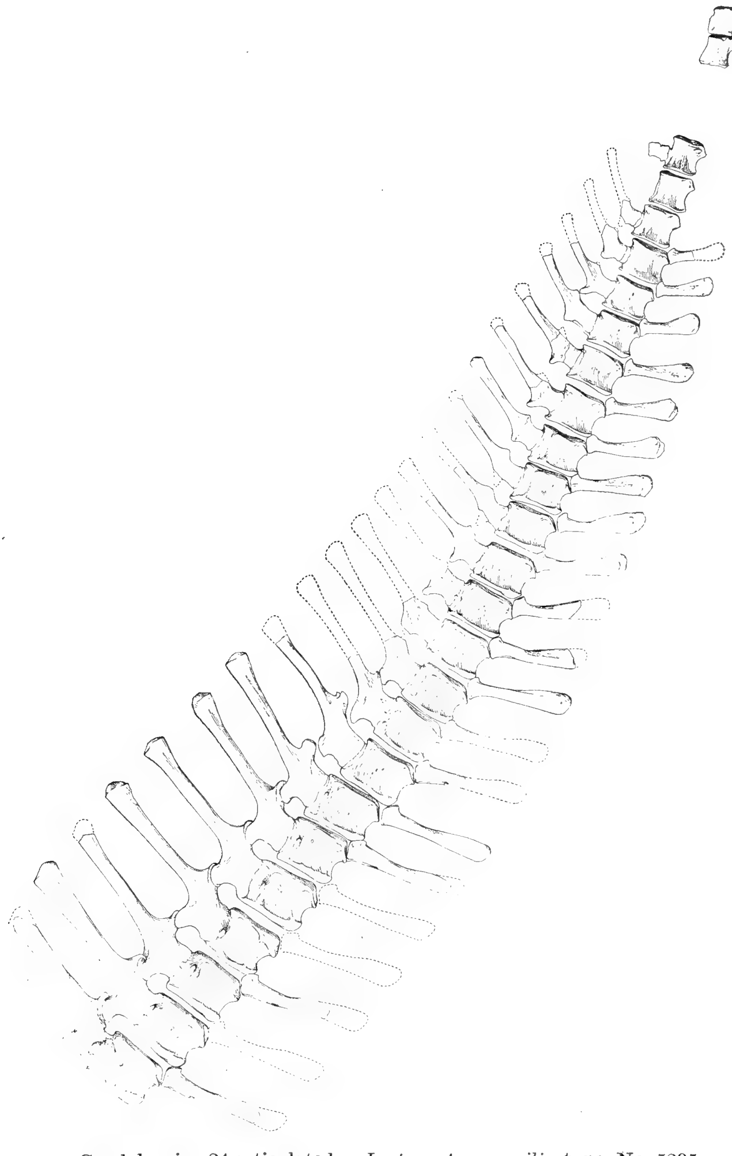

Fig. 10. Caudal series, 24 articulated. *Leptoceratops gracilis*, type, No. 5205, nat size.

Fig. 11. Right scapula and coracoid. A, lower border; B, outer view. *Leptoceratops gracilis*, type, No. 5205, nat. size.

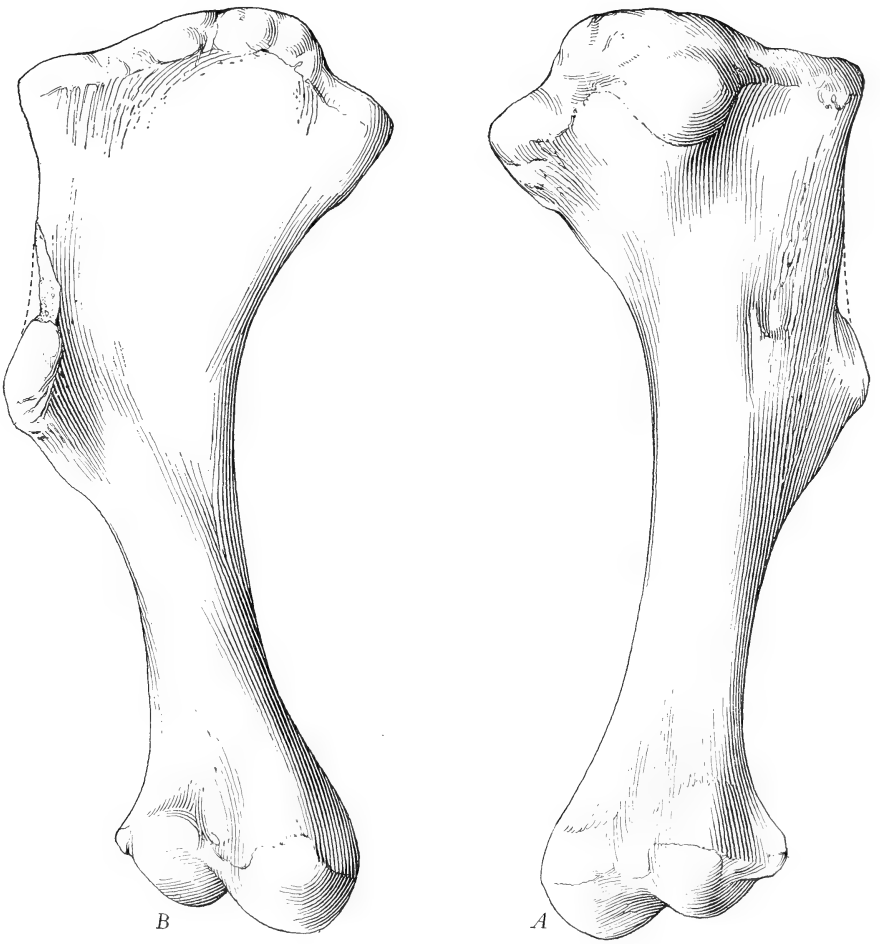

Fig. 12. Right humerus. A, posterior view; B, anterior view. *Leptoceratops gracilis*, type, No. 5205, nat. size.

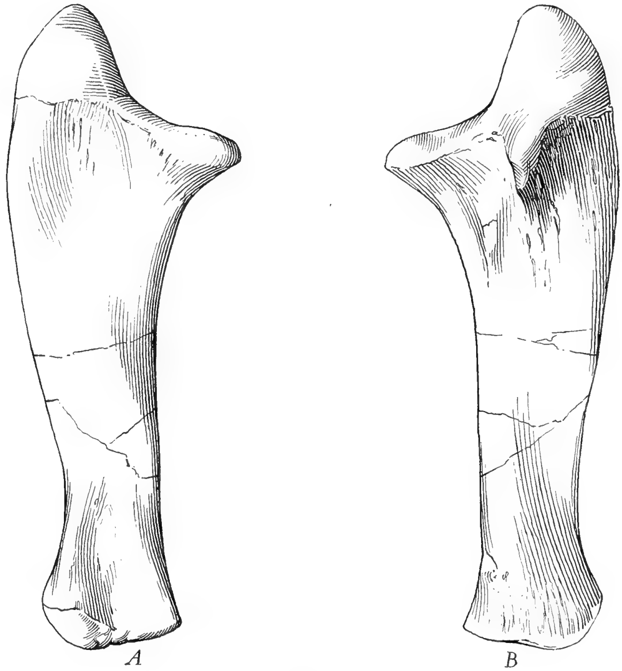

Fig. 13.

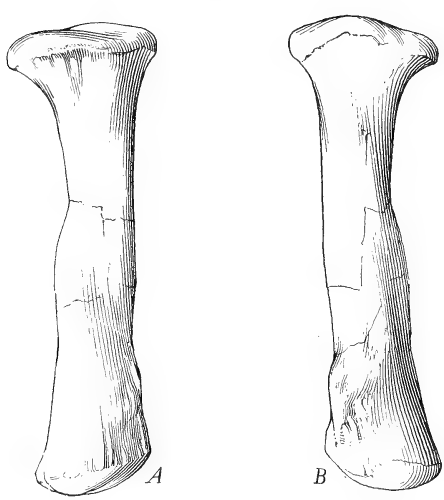

Fig. 14.

Fig. 13. Left ulna. A, posterior view; B, anterior view. *Leptoceratops gracilis*, type, No. 5205, nat. size.

Fig. 14. Left radius. A, outer view; B, inner view. *Leptoceratops gracilis*, type, No. 5205, nat. size.

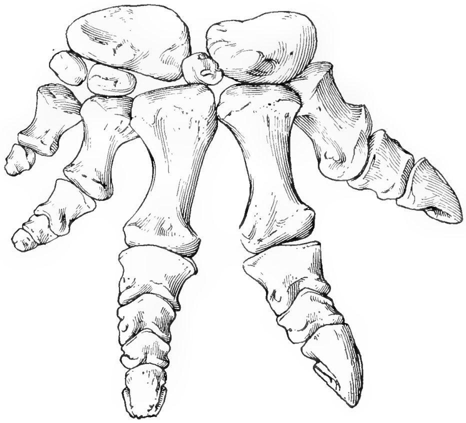

Fig. 15.

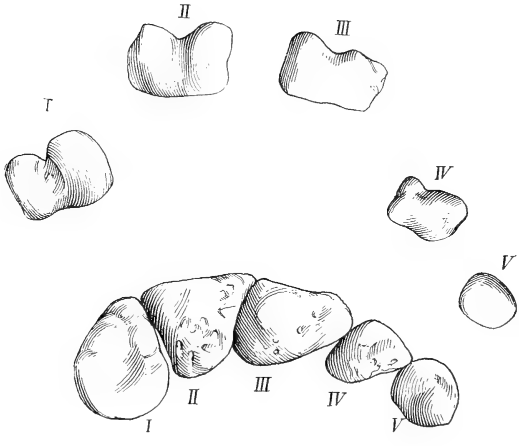

Fig. 16.

Fig. 15. Right manus. *Leptoceratops gracilis*, type, No. 5205, nat. size.
Fig. 16. Articular ends of right metacarpals. *Leptoceratops*, type, No. 5205, nat. size.

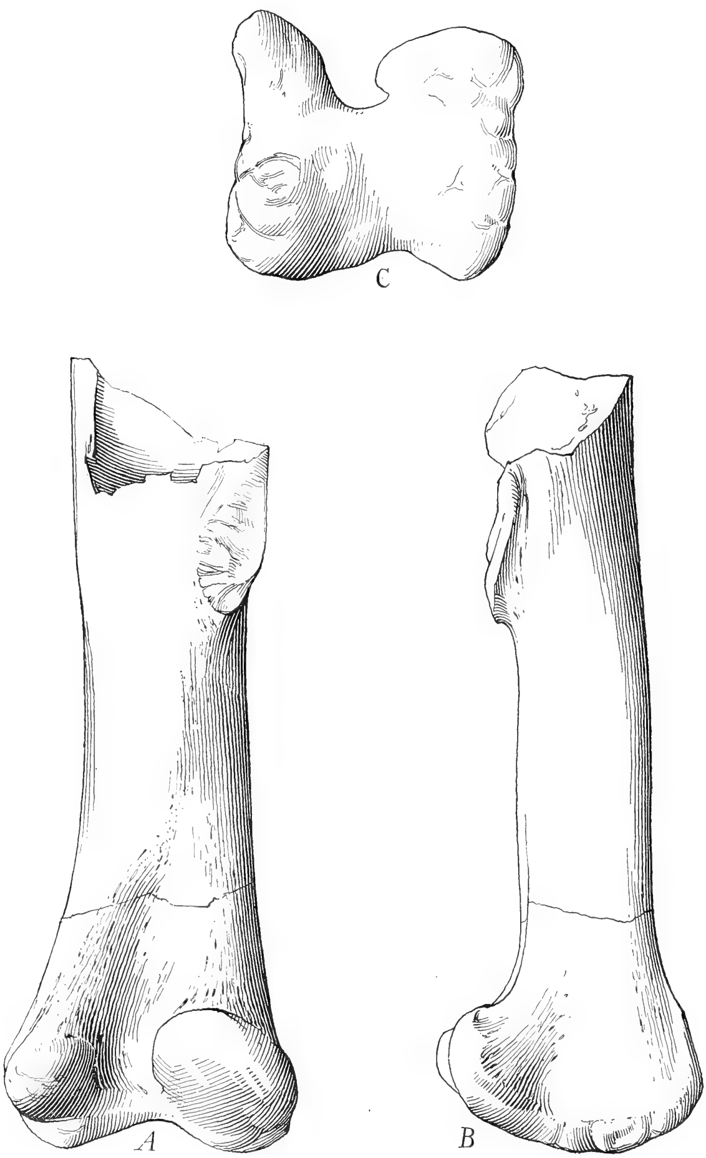

Fig. 17. Left femur. A, posterior face; B, inside; C, distal end. *Leptoceratops gracilis*, type, No. 5205, nat. size.

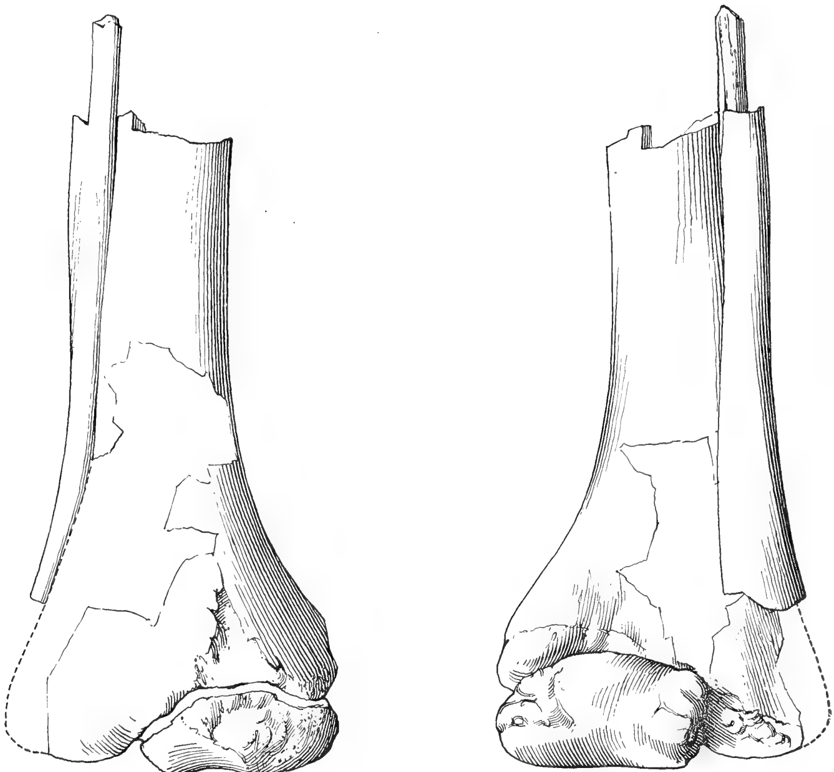

Fig. 18. Left tibia, fibula and astragalus. A, posterior view; B, anterior view. *Leptoceratops gracilis*, type, No. 5205, nat. size.

The femur (Fig. 17) presents several characters that distinguish it from any known in related genera. The shaft is practically straight, round in cross-section and the distal articular face is at right angles to the shaft with borders only slightly reflexed anteriorly and posteriorly. From this type of femur it is evident that the limb was normally carried straight. In outline the distal end is almost square with a deep intercondylar notch, the external about one half as wide as the internal condyle. The fourth trochanter is situated above the middle of the shaft and well developed. It is comparatively larger than in any described Ceratopsian and its large size is correlated with the long tail.

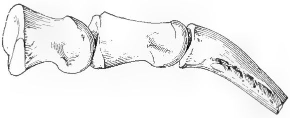

Fig. 19. Phalanges of the pes. *Leptoceratops gracilis*, type, No. 5205, nat. size.

The tibia and fibula (Fig. 18) are developed as in *Triceratops* but the

fibula is proportionately smaller and closer to the shaft of the tibia. Like all of the other limb bones in this specimen the shafts are round as in *Monoclonius.* Distally the tibia is expanded, with surface for attachment of the fibula less extensive than in *Triceratops* or *Monoclonius.* The astragalus is proportionately larger than in *Triceratops* and the calcaneum was evidently reduced in size.

The number of digits in the pes is not determinable. Several phalanges are preserved (Fig. 19), similar in form but larger than those of the manus. The terminal phalanges are long and narrow like those of *Monoclonius* and *Ceratops.*

Leptoceratops is related more closely to *Brachyceratops* than to other Ceratopsia and from the material now available the two genera appear to be distinguished from allied genera by characters of at least subfamily rank.

Measurements.

	mm
Crest, width between squamosals at posterior end	196
Dentary, extreme length	235
" depth at symphysis	100
" height of coronoid process above symphysis	223
Predentary, width at contact with dentary	90
Scapula and coracoid, length	425
Humerus, length	290
" width at proximal end	124
" " " distal "	90
Ulna, length	224
Radius, "	167
Femur, transverse width of distal end	100
" anteroposterior width of distal end	94
" distance from lower edge of trochanter to end	187
Tibia, width across distal end	117

59.7,58A(75.9)

Article XXXVII.— A NEW ANGEL-FISH (*ANGELICHTHYS TOWNSENDI*) FROM KEY WEST.

By John T. Nichols and Louis L. Mowbray.

In collecting fishes for the New York Aquarium at Key West Mr. Mowbray has found three quite distinct species of *Angelichthys* occurring there. Two of these are identifiable as *ciliaris* and *isabelita,* the forms recognized by Jordan and Evermann in Bull. 47, U. S. National Museum; for the third we propose the name *townsendi,* in appreciation of the untiring efforts of Dr. Charles H. Townsend, Director of the Aquarium, to show beautiful coral-reef fishes to the public.

Angelichthys townsendi sp. nov.

Char. sp.— Eye smaller than in *ciliaris* or *isabelita* (5 in head). Preopercular spine short as in *isabelita,* the small spines above it on the ascending limb shorter more numerous and more irregular than in either of the other species. Anal spines IV instead of III as in these. Pectoral and caudal mainly yellow as in *ciliaris,* but like *isabelita* in lacking the prominent ocellus on the nape.

Type. No. 4751 Am. Mus. Nat. Hist., 285 mm. in length to tip of caudal. Key West Florida, June 1914; New York Aquarium.

Description of Type. Head in length to base of caudal 3.7. Depth 1.7. Eye 5 in head, snout 2.25. Interorbital 3. Dorsal XIII, 19. Anal IV, 19. Scales about 45, about twice as deep as broad. Last dorsal spine longest, 1.9 in head, ventral spine 1.8, last anal spine 2.0, pectoral fin 1.35, caudal 1.2. Soft dorsal and anal fins attenuate, extending well beyond tip of caudal. Caudal rounded. Preopercular spine weak for the genus, measured along groove 5 in head, 14–16 irregular very small spines on the ascending limb of preopercle. Two or three small spines on the lower limb of the preorbital angle, none on its ascending limb. Profile almost straight, snout slightly protruding.

Color when fresh grayish green, lips, interorbital, nape, upper margin of opercle, spines of head, breast, and base of pectorals light blue, cheeks and opercle pale greenish blue, inner and outer margins of vertical fins edged with bright blue, an orange stripe beginning at the base of first dorsal spine extending to produced rays, a similar less conspicuous stripe on anal, pectoral and caudal lemon yellow, ventrals very pale yellow, angle of mouth and membrane at angle of opercle orange, eye golden, extreme base of pectoral sky blue, region immediately behind pectoral bright yellow, the margins of the larger scales edged with yellow, forming diagonal lines across the body. Membrane on lower limb of opercle orange.

We have only the type specimen which lived 2 or 3 weeks in the New York Aquarium.

Angelichthys ciliaris (*Linné*).

For the purposes of comparison with *townsendi* we use a dried specimen 320 mm. long to tip of caudal, taken at Key West by Mr. Mowbray, June, 1912.

Head 3.8. Depth 1.65. Eye 4.5. Snout 2.3. Interorbital 2.7. Dorsal XIV, 20. Anal III, 20. Scales about 48, more than twice as deep as broad. Last dorsal spine 2.3. Ventral spine 1.6. Last anal spine 2.3. Pectoral fin 1.3. Caudal 1.2. Preopercular spine strong, with a heavy sheathing membrane, measured along groove 3 in head. Ten prominent spines on the ascending limb of preopercle. Three small spines on the lower limb of the preorbital, and 4 larger radiating ones on the ascending limb. Scales on cheeks larger than in *townsendi* or *isabelita*. Profile as in *townsendi*, but snout more protruding.

Color when fresh greenish, lips, upper edge of opercle, interorbital region, breast, and margin of vertical fins deep blue. Nape with a large ocellus, larger than eye, blue black, spotted with blue and with a narrow blue border. Extreme base of pectoral blue black with narrow border of light blue in front. Last rays of vertical fins blue black, bordered posteriorly with lighter blue. A conspicuous orange stripe extending from ocellus across base of dorsal spines, disappearing on the soft fin. A similar less conspicuous stripe on anal. Scales of sides broadly edged with yellow, forming diagonal yellow bands below lateral line, scattered yellow points above lateral line onto base of soft dorsal. Pectorals, ventrals and caudal and lobes of vertical fins yellow. Eye broadly blue above and below with golden interspace. Spines of head dark blue.

This is the species figured as *ciliaris* by Bloch, 1787, and recently by Evermann and Marsh, Fishes of Porto Rico, 1900. It is rare at Key West from where three other specimens have recently been brought to the New York Aquarium.

Angelichthys isabelita *Jordan & Rutter*.

The following description is taken from a specimen 325 mm. long to tip of caudal, Key West, New York Aquarium, June 1914.

Head 3.7. Depth 1.8. Eye 4.7. Snout 2.2. Interorbital 3. Dorsal XIV, 20. Anal III, 19. Scales 35, less than twice as deep as broad. Last dorsal spine 2.1. Ventral spine 1.85. Last anal spine 2.15. Pectoral fin 1.25. Caudal 1.1. Preopercular spine moderate, measured along groove 4.5. 8–10 prominent spines on ascending limb of preopercle, less strong than in *ciliaris*. Lower limb of preorbital angle with 1–3 very small spines, none on the ascending limb. Profile steep, the nape gibbous, making it concave above the eye. Snout not protruding.

Color when fresh brownish gray, the scales largely brownish, margined with gray, especially on the lower portion of the body. Cheek gray. Nape, breast, spines of the head, upper margin of eye light blue. Outer margin of dorsal and anal narrowly blue. Membrane only of upper limb of opercle blue. Base of pectoral gray, then

broadly blue, the margin first yellow and then pale. Ventrals pale yellow. Caudal dark brownish gray, edged with yellow. Vertical fins the same, produced rays yellow.

This species is common at Key West. It is much more numerous at the Bermudas where it forms one of the most important food fishes. We have several specimens from there, where it is, so far as we know, the only species found, though long wrongly identified as *ciliaris*.

In conclusion the following key may be found useful in determining adults of our Atlantic species of this genus.

A. Ascending limb of preorbital with strong radiating spines. Preopercular spine 3 in head measured along groove. A conspicuous persistent ocellus on nape. *ciliaris.*

AA. Ascending limb of preorbital without spines. Preopercular spine 4 to 5 in head. No ocellus on nape.

B. 4 anal spines. Nape not gibbous. Caudal and most of pectoral yellow. *townsendi.*

BB. 3 anal spines. Nape gibbous. Caudal and pectoral with little yellow. *isabelita.*

59.9,32S(8)

Article XXXVIII.— NEW SOUTH AMERICAN SCIURIDÆ.

By J. A. Allen.

As the publication of my revision of the South American Sciuridæ[1] is likely to be delayed for several months, the following descriptions of new forms are presented in advance of the review of the entire group.

Notosciurus gen. nov.

Size small; ears long, narrow, and pointed; naked portion of plantar surface restricted to apical half, the proximal half heavily furred; toe pads large and crowded; heel pad very large and nearly square, occupying the whole breadth of the foot; palmar surface not especially modified, the toe pads and naked portion as in typical tree squirrels.

Premolars $\frac{1}{1}$. Skull highly convex, the highest part at the fronto-parietal suture; rostrum broad and short; posterior border of nasals square, terminating on a line with the posterior border of premaxillaries; infraorbital foramen broad, subcircular; malar broad, rather heavy; audital bullæ greatly inflated.

Type. *Notosciurus rhoadsi* sp. nov.

The striking feature of the genus *Notosciurus* is the character of the hind foot, which has the proximal half of the plantar surface heavily furred, and only the distal half (instead of three fourths or more, as in ordinary tree squirrels) naked, and the heel pad close to the toe pads, large, square, transverse to the axis of the foot, instead of long and narrow, and parallel to the edge of the foot. (Figs. 1 and 2.)

Notosciurus rhoadsi sp. nov.

Type, No. 12725, Mus. Philadelphia Acad. Nat. Sciences, ♂ juv., Pagma Forest, Chunchi (altitude 6300 feet), Ecuador; coll. Samuel N. Rhoads, for whom the species is named.

Character of the pelage and coloration nearly as in *Guerlinguetus hoffmanni*, but ears relatively long and narrow, and the proximal half of the soles of the hind feet heavily furred.

Upperparts uniformly finely grizzled pale yellow and dusky, the hairs individually blackish basally and narrowly ringed near the tip with pale yellow and black, mixed sparingly with hairs wholly black, resulting in a pale yellowish brown general effect; underparts ochraceous orange, paler on the chin, throat and sides of nose; limbs externally like the upperparts, and internally like the belly, the feet grizzled with pale orange; ears rufous, well haired on both surfaces; tail grizzled on both

[1] See this Bulletin, Vol. XXXIII, p. 145, Feb. 26, 1914.

surfaces like the back, the tips of the hairs pale orange, the hairs individually narrowly ringed alternately with yellowish buff and black, the undersurface of the tail with a submarginal, rather narrow band of black and long ochraceous tips.

Total length (collector's measurements), 330 mm.; tail vertebræ, 152; hind foot 50; ear, 20.

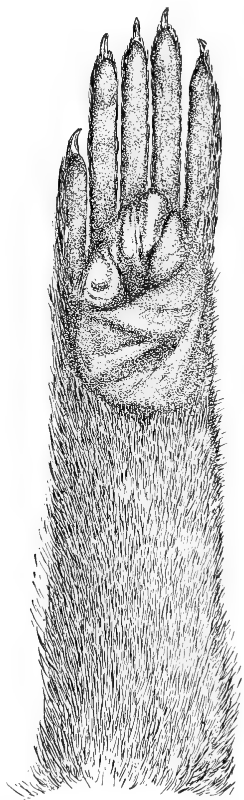

Fig. 1.

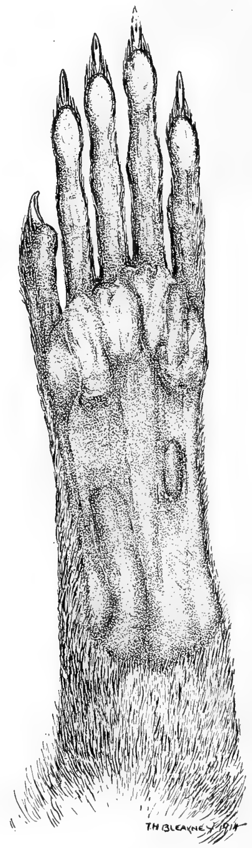

Fig. 2.

Fig. 1. Hind foot of *Notosciurus rhoadsi.* $\frac{2}{1}$.
Fig. 2. Hind foot of *Guerlinguetus hoffmanni* (Peters), for comparison with Fig. 1. $\frac{2}{1}$.

Skull, total length, 47; zygomatic breadth, 27; interorbital breadth, 15; postorbital breadth, 13; breadth of braincase, 22.5; nasals, 14×7; diastema, 11; maxillary toothrow, 8. The skull still retains the milk premolars, and therefore the specimen is not fully adult, although it has the appearance of being adult in all other respects.

The general appearance of *Notosciurus rhoadsi* is that of a pale *hoffmanni* in miniature, in bulk *N. rhoadsi* being less than half the size of *hoffmanni*. This renders further comparisons needless.

I am indebted to Dr. Witmer Stone, curator of mammals and birds at the Philadelphia Academy of Natural Sciences, for the opportunity to make known this remarkable little squirrel.

Guerlinguetus pucheranii salentensis subsp. nov.

Type, No. 32840, ♀ ad., near Salento (altitude 9000 ft.), Central Andes, Colombia, Nov. 8, 1911; Leo E. Miller.

Pelage very soft and thick. Upperparts with a broad median dusky band, sparingly punctated with ochraceous, the rest of the upperparts with the hairs broadly tipped with bright ochraceous; underparts nearly uniform pale yellow; tail as usual in the group, blackish above washed with white, below grizzled ochraceous and black edged with white.

Total length (type, collector's measurements), 310 mm.; head and body, 150; tail vertebræ, 150; hind foot, 40. Six adult specimens, Salento and a little above Salento (7000–9000 feet). Total length, 300.5 (288–310); head and body, 153 (148–163); tail vertebræ, 159.5 (135–150); hind foot, 41.7 (40–45).

Represented by 14 specimens: Salento and vicinity, 7; El Roble, 2; Laguneta, 2; Miraflores, 2; Palmira, 1 (all from localities in the Central Andes).

In three specimens the dorsal band is black, broad, and sharply defined; in two it is obsolete; in all the others it is merely a darkening of the median line, the black basal portion of the hairs being lightly tipped with ochraceous. The two specimens from Miraflores (alt. 6200 ft.) and the single specimen from Palmira very closely resemble those from La Guneta (alt. 10,300 ft.), El Roble, and part of the Salento specimens; one, however, from above Salento (alt. 9000 ft.) and one from Salento differ from the others in being nearly white below with only a faint yellowish wash — doubtless merely individual variants.

Guerlinguetus hoffmanni quindianus subsp. nov.

Type, No. 32835, ♂ ad., Rio Frio (central Rio Cauca Valley, altitude 3500 feet), western slope of Central (or Quindio) Andes, Nov. 27, 1911; Leo E. Miller.

Upperparts with the mid-dorsal region black, extending (in different specimens) from the nape or shoulders to the base of the tail; rest of the upperparts finely grizzled yellowish and black varying (in different specimens) to ochraceous and black; outer surface of limbs and feet like the flanks; underparts ochraceous orange varying (in different specimens) to orange red; inside of limbs like the ventral surface; tail above black at the extreme base (for about 30 to 50 mm.), then orange (pale orange to orange red in different specimens) and tipped with black (usually for the terminal 40 to 50 mm.); under surface of tail grizzled fulvous and black, with black base and tip, and broadly edged with orange, the hairs individually black at base, then broadly banded with orange, followed by a broad band of black, and a very broad terminal band of orange; ears medium, clothed with very short hairs similar in color to the adjoining pelage.

Total length (collector's measurements), 397 mm.; head and body, 215; tail vertebræ, 182; hind foot, 55. Six topotypes, total length, 400 (375–440); head and body, 221 (202–230, 1 at 242); tail vertebræ, 179 (146–198); hind foot, 56 (53–58). Eleven specimens from Salento (altitude 9000 feet), total length, 395 (390–418); head and body, 218 (205–226); tail vertebræ, 176 (162–203); hind foot, 56 (54–58).

Skull (type), total length, 56; zygomatic breadth, 31.5; interorbital breadth, 16; breadth of braincase, 24: length of nasals, 16.4; maxillary toothrow, 8.6. Four topotypes, total length, 54.4 (53–55); zygomatic breadth, 31.3 (30–32); interorbital breadth, 16.1 (15.5–17); breadth of braincase, 23.4 (22.8–23.8); length of nasals 16 (15.5–16.5); maxillary toothrow, 8.2 (8–8.5). Salento and Laguneta skulls have practically the same measurements, the skulls from these four localities exceeding in size those of true *hoffmanni* from any of the numerous localities in Central and South America from which series of specimens have been received.

The following specimens are referred to *Guerlinguetus hoffmanni quindianus:* Rio Frio (alt. 8500 ft.), 6; Salencio (Nóvita trail, alt. 5500 ft.), 1; Salento (alt. 9000 ft.), 2; Laguneta (alt. 10,300 ft., near the top of the Central Andes), 5; Passada Tores (alt. 3000 ft.), 2; Cauca Valley,[1] 1. All are from the west slope of the Central Range except the single specimen from Salencio, which is in the Valley of the Rio Cauca, west of the river at the base of the Western Andes, yet it is indistinguishable from average specimens from Rio Frio and Salento.

The Laguneta specimens are from near Quindio Pass, and hence from near the summit of the Central Andes. The Laguneta series is aberrant, approaching typical *hoffmanni,* the mid-dorsal region being only slightly darker than the flanks in two, and decidedly black in the other two, the latter thus agreeing with typical examples of *quindianus.* Specimens from El Eden (alt. 8300 ft.), on the eastern slope of the Central Andes, about 30 miles southeast of Laguneta, are indistinguishable from *hoffmanni* of the Western Andes (Las Lomitas, San Antonio, and thence southward), and from Miraflores in the Central Andes (about 90 miles south of Laguneta).

Specimens from the near vicinity of Bogotá, on the eastern slope of the Eastern Andes, are referable to *G. hoffmanni hyporrhodus* (Gray). These, however, show a tendency to a darkening of the mid-dorsal region, several specimens from Fusugasugá and Panamá being in this respect similar to typical examples of *quindianus.* Both forms agree in the deep orange red of the belly and the upper surface and edges of the tail. The relationships of these two forms, as regards coloration, may be expressed as follows: *quindianus* is normally a black-backed form, with occasional specimens in which

[1] This is one of J. H. Batty's specimens, and the exact position of the locality is not known, but it must be on the middle Rio Cauca, as the collector says on the back of the label "species much darker in higher altitudes," indicating some point near Rio Frio.

the dark dorsal band is poorly developed; *hyporrhodus* is normally without a dark dorsal band, with occasional specimens in which it is more or less shown. Were it not that their ranges are separated by the Magdalena Valley, with an altitude at this point of less than 1000 feet, it would seem reasonable to expect that the two forms will be found to completely intergrade geographically as well as through individual variation. It is already pretty evident that both intergrade with *hoffmanni* to the southward in both the Eastern and Central Andes and probably in the Western Andes.

Guerlinguetus hoffmanni manavi subsp. nov.

Type, No. 34286, ♀ ad., Manavi (Rio de Oro, near sea-level), Ecuador, Jan. 23, 1913; W. B. Richardson.

Similar to *G. hoffmanni hoffmanni* in size and general coloration, but with the proximal half or two thirds of the tail below nearly black, the hairs basally black narrowly ringed with fulvous giving a slightly grizzled effect, followed by a broad zone of black and a slight tipping of reddish orange; apical half or third of the tail below black slightly grizzled with fulvous or orange, the hairs broadly tipped with orange red; whole upper surface of the tail grizzled black and orange red, the surface color of the apical third almost wholly orange red.

Total length (type), 410 mm.; head and body, 230; tail vertebræ, 180; hind foot (c. u. in dry skin), 52. Skull, total length, 52; zygomatic breadth, 31; interorbital breadth, 16; breadth of braincase, 24; length of nasals, 15; diastema, 13; maxillary toothrow, 8.8.

Represented by 5 specimens from Manavi and 3 from Esmeraldas. As a series the underparts average distinctly redder than in *hoffmanni* from Costa Rica, Chiriqui, or the Western Andes of Colombia. Specimens from Santa Rosa and Loja are intermediate between the coast form and specimens from the interior collected at Zaruma, Gualea and Nariño, at altitudes of 6000 to 8000 feet; the Santa Rosa specimens are so much nearer the Manavi and Esmeraldas specimens as to be referable to *manavi*. Gualea specimens are indistinguishable from true *hoffmanni*. *G. h. manavi* is a coast form, and ranges from Esmeraldas south to the Peruvian boundary.

Guerlinguetus griseimembra sp. nov.

Type, No. 34611, ad. ♀, Buenavista (altitude 4500 ft.), eastern slope of Eastern Andes, about 50 miles southeast of Bogotá, March 8, 1912; G. M. O'Connell.

Upperparts finely grizzled ochraceous orange and black, not appreciably darker on the median dorsal area; underparts washed with pale ochraceous buff, strongest over the pectoral region, paler on the lower abdomen; lateral edges grayish, forming sometimes an ill-defined gray lateral line; chin and throat dull buffy gray; fore limbs entirely dark gray, the tips of the hairs lighter (whitish or buffy in different specimens); hind limbs externally like the body, internally gray like the fore limbs; ears

colored like the adjoining surface, with a small patch of soft fulvous hairs at the posterior base; tail above washed with pale ochraceous, the general effect grizzled ochraceous and black, with a broad subterminal band of black, but base concolor with the back; under surface of the tail similar to the upper, broadly edged with ochraceous.

Total length (collector's measurements), 402 mm.; head and body, 219; tail vertebræ, 183; hind foot, 55. Type and 3 topotypes, total length, 394 (377–411); head and body, 213 (188–225); tail vertebræ, 182 (162–192); hind foot, 56 (55–58).

Skull, total length, 51; zygomatic breadth, 31; interorbital breadth, 16; breadth of braincase, 22.7; length of nasals, 15.5; maxillary toothrow, 8. Four skulls (type and 3 topotypes, all adult), total length, 51.2 (50.3–53); zygomatic breadth, 30.6 (30–31); interorbital breadth, 16.1 (15–17); breadth of braincase, 22.7 (22–23.2); length of nasals, 15.5 (15–16); maxillary toothrow, 8.2 (8–8.6).

Represented by 4 specimens from Buenavista (near Bogotá) and 1 from Andalucia (alt. 5000 ft.). All are from the eastern slope of the Eastern Andes, Andalucia being about 150 miles southwest of Buenavista.

The distinctive feature of *G. griseimembra* is the entirely gray fore limbs and the gray inner surface of the hind limbs, in which it differs strikingly from any of the forms of *G. hoffmanni.* In general coloration some specimens closely approach true *hoffmanni,* but the underparts average much paler, and the tail is paler and less heavily washed with ochraceous. It differs still more in coloration from *hyporrhodus,* specimens of which have been received from nearby localities in the Bogotá district to the northward; it is also smaller, the skull especially being smaller and more delicate. It is very much smaller than *quindianus* of the Central Andes (the skull 3 mm. shorter, and all other cranial measurements in proportion), and widely different in coloration.

The four specimens of the type series vary considerably in coloration of the underparts, ranging from a strong wash of ochraceous yellow (in one specimen) to a slighter wash of ochraceous buff. The single specimen from Andalucia is the palest of the five, and the gray of the limbs is the deepest and strongest, probably indicating that the extreme phase of the species may be looked for to the southward of the type locality.

Guerlinguetus candelensis sp. nov.

Type, No. 33670, ♀ ad., La Candela (altitude 6500 ft.), near San Agustin, Huila, Colombia, May 11, 1912; Leo E. Miller.

Upperparts (type) minutely punctated with pale orange yellow and dark brown, the hairs being blackish with minute yellow tips, the mid-dorsal region slightly darker than the flanks; underparts with the tips of the hairs white on the throat and pectoral region and middle of the lower abdomen, and with pale ochraceous over the mid-abdominal region; lower border of the sides of the neck, outer surface of fore limbs, edge of thighs and outer surface of hind limbs washed with ochraceous; inner surface

of fore limbs grayish white like the breast; inner surface of hind limbs with a broad central line of whitish bordered with a wash of ochraceous; tail above heavily washed with red or orange red, black for about 40 mm. at the tip; under surface of tail centrally grizzled pale ochraceous and black, with a submarginal band of black, and a narrow edging of red, the tip of the tail black; ears colored like the surrounding surface, with a bare trace of a post-auricular patch of soft fulvous hairs.

Total length (type, collector's measurements), 380 mm.; head and body, 190; tail vertebræ, 190; hind foot, 53. Eight specimens (type and 7 topotypes), total length, 390 (380–420, only 1 above 400); head and body, 208 (190–230); tail vertebræ, 181 (160–200); hind foot (in dry skin), 52.8 (51–55).

Skull (type), total length, 51.2; zygomatic breadth, 29; interorbital breadth, 16; breadth of braincase, 22.6; length of nasals, 15.5; maxillary toothrow, 8.5. Three adult skulls (type and 2 topotypes), total length, 51.3 (51–52.5); zygomatic breadth, 29.5 (29–30); interorbital breadth, 16 (16–16); breadth of braincase, 23 (22.6–23.3); length of nasals, 15.3 (15–15.5); maxillary toothrow, 8.5 (8.2–8.8).

Represented by 11 specimens: La Candela, 8 (type and topotypes); La Palma (alt. 5500 ft.), a few miles west of La Candela and 1000 ft. lower, 3. In coloration and measurements the La Palma specimens agree perfectly with the type series.

The specimens referred to *G. candelensis* all agree in the coloration of the upperparts and of the tail, but present a wide range of individual variation in the coloration of the underparts, which vary from nearly uniform clear grayish white to orange red on the whole abdominal area, with the upper chest and throat buff. In 5 of the specimens the underparts are almost wholly grayish white, with a tendency to a pale buffy wash over the middle of the belly; in 7 others the underparts are washed with pale orange yellow with the throat and chest mostly white; in one the whole undersurface is rich orange red. The specimen selected as type is of the medium phase of coloration. It may be added that the white on the underparts is plainly not albinistic, as in many normally red-bellied squirrels, the white being limited to the apical portion, the basal fur in all being plumbeous.

The nearest relative of *G. candelensis* is *G. griseimembra,* adjoining it to the northward in the Eastern Andes. Both are similar in size and in cranial characters, but differ radically in coloration. In *candelensis* the legs and feet are not gray but like the adjoining parts of the body; the coloration of the upperparts is many shades darker, the yellow tips to the hairs being much shorter, and the tail is superficially dark red instead of pale ochraceous.

It is interesting to note, in respect to its nearest geographical allies, that the range of *G. griseimembra* nearly joins that of *candelensis* to the northeastward, while typical *hoffmanni* is abundant 50 miles to the westward at Almaguer and La Sierra, and also northward in the Western Andes, with which, however, *candelensis* has no near relationship.

The type locality is on the western slope of the Eastern Andes, on the Rio Suaza, one of the upper sources of the Rio Magdalena.

Sciurus gerrardi salaquensis subsp. nov.

Type, No. 33078, ♂ ad., Rio Salaqui, northwestern Colombia; Mrs. E. L. Kerr.

Similar to *S. gerrardi choco* in coloration and other external features, but tail without a black tip, and sides of body more ferruginous. Upperparts with a broad median black band extending from the shoulders posteriorly over the proximal third of the tail; sides ochraceous lined with black; outside of fore limbs orange red, inside like the ventral surface; thighs and outside of hind limbs paler than shoulders and fore limbs; underparts deep orange red, with irregular blotches and lines of white (in type a large pectoral area, axillæ, and a narrow median line white); tail above, proximal third black, rest bright red without black at the tip; under surface of tail for proximal third, and median area to end of vertebræ, grizzled ochraceous and black, distal two thirds and the tip broadly fringed with bright red. An adult female and a young female from the type locality are like the type.

Total length (type, from skin), 470 mm.; head and body, 240; tail vertebræ, 230; hind foot, 60. Unfortunately the skull has been lost, but doubtless would, if available, present no tangible differences from the skulls of neighboring forms of the *gerrardi* group.

Represented by 7 specimens, of which 3 are from Rio Salaqui, 1 from Rio Atrato, and 3 from Nercua. The last 4 are in the U. S. National Museum.

A specimen from the Atrato River, collected by A. Schott a half century ago, agrees perfectly with the type series. Three other specimens (in bad condition) also collected by Schott are obviously referable to the same form. Rio Salaqui is a western tributary of the Rio Atrato. All the known localities from which specimens of *salaquensis* have been received are in the Rio Atrato drainage.

Salaquensis intergrades with subspecies *choco* of eastern Panama. To the southward along the coast it evidently intergrades with true *gerrardi,* as shown by specimens from Baudo and Bagado, through the greatly increased intensity of the red on the flanks and limbs.

Sciurus gerrardi cucutæ subsp. nov.

Sciurus versicolor Osgood (not of Thomas), Field Mus. Nat. Hist., Zool., X, No. 5, p. 47, Jan. 10, 1912.

Type No. 18728, ♀ ad., Field Museum, El Guayabal, 10 miles north of San José de Cucuta, Colombia (near Venezuela boundary), March 13, 1911; Osgood and Jewett.

Similar to *S. gerrardi zuliæ* but much paler, the black of the upperparts duller and less glossy, the red of the underparts orange instead of orange red, the black on base of tail above and at tip more restricted and less intense.

Type (collector's measurements), total length, 433 mm.; head and body, 215; tail vertebræ, 218; hind foot, 57. Skull, total length, 54; zygomatic breadth, 31.2; interorbital breadth, 17.4; breadth of braincase, 23.5; length of nasals, 16.5; maxillary toothrow, 9.

Represented by 5 specimens, all females and all from the type locality, El Guayabal, on the border line between the humid and arid districts. The deviation of *cucutæ* from *zuliæ* is towards subspecies *choco*, but the two forms do not closely resemble each other, and are geographically widely separated.

A single specimen from Rio San Jorge (alt. 1000 ft.) closely resembles *zuliæ* in general coloration, including the orange red feet so distinctive of *zuliæ* and *cucutæ* but absent in the other forms of the *gerrardi* group. The proximal fourth of the upper surface of the tail is black, but the black at the tip of the tail is very restricted, consisting of only the terminal hairs. The bright red of the shoulders extends to the mid-dorsal line, as happens sometimes in both true *gerrardi* and *zuliæ*. It is probable that this specimen represents a geographical form occurring in northern and northwestern Colombia connecting *gerrardi* directly with *zuliæ*. Further material is necessary to determine the point, no other specimens from this large area being at present available.

Sciurus saltuensis magdalenæ subsp. nov.

Type, No. 34626, ♂ ad., Banco (altitude 50–100 feet) Rio Magdalena, a few miles above mouth of Rio Caura; G. M. O'Connell.

Pelage short, coarse and rigid, almost without underfur. Upperparts uniform deep red except front and sides of head, which are orange yellow; underparts and proximal portion of inside of limbs pure white; chin orange yellow, passing into orange red on the throat, sharply contrasting with the white of the lower throat and chest; tail wholly intense dark red from base to tip, both above and below; upper arms and thighs deep red like the upperparts; fore and hind feet orange red.

In a second specimen (topotype) the red of the flanks and limbs is still darker, the hairs of the back subapically narrowly ringed with black, thus distinctly darkening the median dorsal area, which is extended over the proximal third of the tail.

Total length (type), 434 mm.; head and body, 245; tail vertebræ, 189; hind foot, 56. Topotype (♂ ad.), 422, 238, 184, 60. The skull has been temporarily mislaid; measurements of it may be given later.

Known only from two specimens, from Banco, Colombia, on the Rio Magdalena just above the mouth of the Rio Caura.

This subspecies is exactly similar in pattern of coloration to *S. saltuensis bondæ*, but the pelage is coarse and hispid instead of long and soft, and the red is much darker and more vivid. The type locality is at the mouth of the Rio Cesar, which has its source in the Sierra de Santa Marta. Doubtless squirrels of the *saltuensis* group will be found at favorable localities throughout the course of the Rio Cesar, the mouth of which is in the humid tropical, while the region about Bonda is arid, the change in the character of the pelage and the intensification of the color in *magdalenæ* being doubtless due to its more humid environment.

Sciurus duida sp. nov.

Type, 36153,[1] ♀ ad., Rio Cunucunumá (altitude 700 feet), base of Mount Duida, Venezuela, March 31, 1913; Leo E. Miller.

Size large, pelage long and soft with abundant underfur; tail very broad. Upperparts (type) blackish washed lightly with pale cream color, the hairs brownish black slightly tipped with cream color, the general surface effect yellowish gray on a brownish black ground color; top of head darker brown, the hairs minutely tipped with pale rufous; sides of head cinnamon brown; lower back and rump scarcely darker than the middle of the back but the hairs are tipped with very pale rufous instead of cream color; underparts dark ferruginous to the base, the upper chest and throat paler; fore limbs and feet intense deep rufous; hind limbs externally chestnut grizzled with black, internally dark ferruginous; upper surface of hind feet reddish orange; tail above black for about the basal fifth, rest of the upper surface washed lightly with orange yellow, the black subbasal portion of the hairs strongly visible at the surface, the base of the hairs annulated with pale buff; tail below almost wholly intense black for the proximal half, the distal half grizzled black and pale orange yellow, black predominating, and narrowly fringed with pale orange yellow. One of the two topotypes is like the type, in the other the hair tips of the upperparts and the fringe of the tail are a little deeper tone of yellow.

Total length (type), 560 mm.; head and body, 270; tail vertebræ, 290; hind foot, 65. The lateral hairs of the tail are fully 75 mm. long, and when the hairs are directed laterally give a breadth of fully 6 inches,— about one third greater than in *S. tricolor* or in any member of the *langsdorffii-igniventris-pyrrhonotus* group.

Skull (type), total length, 66; zygomatic breadth, 38; interorbital breadth, 20; postorbital breadth, 19.3; breadth of braincase, 25; nasals, 22 × 8.2; diastema, 19; maxillary toothrow, 10. Rostrum relatively long and narrow.

Represented by 3 specimens collected on the Rio Cunucunumá, at the southern base of Mount Duida, by Leo E. Miller.

In the form of the skull *Sciurus duida* most nearly resembles *S. tricolor*, especially in the narrow, slender, and relatively long rostrum, but it has no resemblance to that species in coloration or texture of pelage, in which it most resembles the *igniventris* group, with which, however, the form of the skull denotes no close relationship. A striking feature of this species is its magnificent tail, which is fully one third broader than that of any other South American squirrel.

Sciurus igniventris zamoræ subsp. nov.

Type (and only specimen), No. 36538, ♂ ad., Zamora, (altitude 2,000 feet), Ecuador, Oct. 29, 1913; W. B. Richardson.

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[1] The collector's number on the skull unfortunately was lost, but by exclusion it must have belonged to one of the three skins of this species, and almost beyond doubt to the one here selected as type, the other two being young adults, while this is fully adult, like the type skin.

Similar to *S. igniventris cocalis* but much smaller, with the whole under surface of the tail black except a narrow orange red border on the apical two thirds, and other color differences.

Upperparts blackish, the hairs tipped with chestnut, very minutely over the dorsal region, more broadly on the flanks, and with fine punctations of yellow on the head; postauricular patches orange; underparts nearly uniform pale ochraceous buff, brighter on inside of fore and hind limbs and laterally; tail above dull black for the basal third, the hairs strongly tipped with chestnut, the rest bright orange, the hairs black subbasally for half their length, with long orange tips; lower surface of tail grizzled red and black for the proximal fourth, the red predominating, followed by a broad band of black extending nearly to the tip of the tail and narrowly fringed with orange, black thus prevailing from near the base, to the tip, with an outer border of orange, the terminal hairs black for half their length; fore limbs and feet externally light yellow; hind limbs externally chestnut, the feet pale orange.

Total length (in skin), 490 mm.; head and body, 260; tail vertebræ, 230; hind foot, c. u., 61. (The collector's measurements give the total length as 520, which is obviously erroneous, and the tail as 230).

Skull, total length, 59; zygomatic breadth, 33.5; interorbital breadth, 19; postorbital breadth, 20.5; breadth of braincase, 25; nasals, 16.3 × 9; maxillary toothrow, 9.2. The type is an old male with much worn teeth.

Sciurus igniventris zamoræ differs from *cocalis,* its nearest geographical representative, in much smaller size, the total length being about 60 mm. less than in *cocalis,* the total length and zygomatic breadth of the skull 3.5 mm. less, and other cranial measurements proportionally less. While the general coloration is similar to that of *cocalis* there are many minor differences, aside from the color of the tail, which differs in the presence of a much larger amount of black on the under surface. It thus differs in coloration from true *igniventris* as *tædifer* does, but in the opposite direction, having much more black in the tail instead of less. In addition to this is the marked difference in size, *zamoræ* being much smaller than any other subspecies of the *igniventris* group. The type locality of *zamoræ* is 250 to 300 miles from any known locality of *cocalis* and in a quite different environment. Either *zamoræ* is a small form of *cocalis,* or the type must be construed as a dwarf, and its color differentiation as an individual aberration, although it has the appearance of being in every way a normal adult.

Sciurus langsdorffii urucumus subsp. nov.

Type, No. 37068, ♂ ad., Urucum (altitude 400 feet), Rio Paraguay (at mouth of Rio Tacuari), Brazil, Dec. 1, 1913; Leo E. Miller (Roosevelt Expedition).

Similar in general to *S. langsdorffii langsdorffii,* but much smaller and darker colored, with much blacker tail. Upperparts dusky brown, the hairs brownish black minutely tipped with yellowish; nose and front of head pale orange with a narrow median stripe of black on the nose; lower back and rump with tips of the hairs inclining to dark rufous; ears externally blackish edged with rufous; postauricular patch

of soft rufous hairs conspicuous; underparts nearly uniform ochraceous buff; fore limbs and feet externally grizzled buff and black; hind limbs externally light chestnut, feet grizzled dark rufous and black; tail above for the basal fourth intense black, usually a few of the hairs tipped with chestnut; rest of the upper surface of tail pale orange, the hairs black for the greater part of their length, tipped with pale orange, through which the black basal portion of the hairs is more or less visible; tail below for the basal third or more, and medially often nearly to the end, intense black, fringed with orange for the apical two thirds and at the tip.

Total length (type, collector's measurements), 500 mm.; head and body, 260; tail vertebræ, 260; hind foot, s. u., 60, c. u., 63. Six adults (all topotypes), total length, 502 (490–530), head and body, 251 (240–260); tail vertebræ, 250 (230–260); hind foot, c. u., 60.5 (60–63).

Skull (type), total length, 57; zygomatic breadth, 35.2; interorbital breadth, 19; postorbital breadth, 18; breadth of braincase, 23.2; nasals, 17 × 7; diastema, 16; maxillary toothrow, 8.5. Seven skulls (type and 6 topotypes), total length, 59 (57–61); zygomatic breadth, 35 (34.6–36); interorbital breadth, 19.6 (19–21); postorbital breadth, 18.3 (18–19); breadth of braincase, 23.4 (22.6–24); nasals, 18.3 × 7.4 (17.5–19 × 7–8); diastema, 17 (16–18); maxillary toothrow, 8.8 (8.3–9.2).

Represented by 9 specimens, of which 7 are from Urucum and 2 from Tapiropoan.

The type locality of *S. l. urucumus* is at the mouth of the Rio Tacuari, on the Rio Paraguay, about 350 miles south of Chapada, Matto Grosso. The external measurements seem to exceed slightly those of *langsdorffii*, and of *steinbachi* from Santa Cruz de la Sierra, Bolivia, but the skulls of *urucumus* are markedly smaller, the total length of the skull being 3 to 4 mm. less, with corresponding differences in all other measurements. The coloration in *urucumus* is much darker than in either *langsdorffii* or *steinbachi*, the light tips to the hairs being shorter and paler, while the black in the tail is more intense and greatly increased in area.

Sciurus langsdorffii steinbachi subsp. nov.

Type, No. 1938 (Pittsburgh Museum), ♀ ad., Santa Cruz de la Sierra, Bolivia June 14, 1909; collected by T. Steinbach, for whom this form is named.

Differs from *S. langsdorffii langsdorffii* in much paler coloration throughout, the hairs of upperparts being slightly tipped with pale yellow instead of heavily tipped with orange; the top of the head and nape slightly washed with yellow instead of orange rufous; nose and sides of head dull yellowish instead of deep rufous; thighs rufous instead of chestnut; underparts pale yellow instead of ochraceous yellow, and tail fringed with a lighter shade of yellow.

Total length (type, collector's measurements), 505 mm.; head and body, 250; tail vertebræ, 255; hind foot, 55; ear, 32. Five specimens (including type), total length, 491 (475–505); head and body, 254 (250–260); tail vertebræ, 235 (225–255); hind foot, s. u., 55 (55–55).

Skull (type), total length, 63; zygomatic breadth, 37; interorbital breadth, 23; postorbital breadth, 19; breadth of braincase, 23; nasals, 20 × 9; maxillary tooth-

row, 9. Five skulls (including type), total length, 60.6 (60.2–61); zygomatic breadth, 36 (35–37); interorbital breadth, 20.6 (20–21); postorbital breadth, 18.6 (18–19); breadth of braincase, 23.6 (23–24); nasals, 18.3 × 7.9 (17.8–19.8 × 7.6–8); maxillary toothrow, 9 (9–9.2).

Represented by 5 adult specimens (3 males, 2 females) collected by T. Steinbach at Santa Cruz de la Sierra, Bolivia, June 16–July 28, 1909, for the Pittsburgh Museum.

Subspecies *steinbachi* agrees closely in size with true *langsdorffii* (type locality by designation of Wagner, 1843, and Thomas, 1904) Cuyabá, Matto Grosso, and also in general coloration, but readily distinguishable by the absence of the strong rufous color of the head present in both *langsdorffii* and *urucumus*. The type locality is about 300 miles southwest of Cuyubá, and about the same distance west of the type locality of *urucumus*.

I am indebted to the authorities of the Pittsburgh Museum for the use of this and much other squirrel material collected by Steinbach in Bolivia.

Sciurus stramineus zarumæ subsp. nov.

Type, No. 36537, ♀ ad., Zaruma (altitude 6000 feet), southwestern Ecuador, Sept. 27, 1913; William B. Richardson.

Like *S. stramineus nebouxi* in the presence of a large white nape patch, but widely different in general coloration from either typical *stramineus* or *nebouxi*.

Upperparts (except the white nape patch) washed with yellowish rufous, more heavily and more intensely (approaching tawny) on the posterior half of the back and hind limbs, more lightly on the head and anterior half of back, the black basal portion of the pelage wholly concealed by the long rufous tipping of the hairs, which on the lower back is half the length of the pelage; nose and outside of fore limbs grayish; underparts gray, passing into white on the throat, upper breast, inside of fore limbs and inguinal region; upper surface of fore and hind feet intense black, wrists rufous, especially the inner surface, and the rufous on the hind limbs extends slightly beyond ankles; tail rufous all around where it joins the body, the rest black heavily washed with white.

Total length (collector's measurements), 540; head and body, 220, tail vertebræ, 320; hind foot, 60. Skull, total length —; zygomatic breadth, —; interorbital breadth, 19; postorbital breadth, 17; breadth of braincase, 23; nasals, —; diastema, 14; maxillary toothrow, 10. The nasals and zygomatic arches are unfortunately broken.

Although represented by only a single specimen, the color differences are so profound that, taken with the geographical conditions, it is hard to believe that they do not denote a strongly marked form of the *stramineus* group. The rufous tips of the hairs on the lower back are as long as the dark basal portion.

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Article XXXIX.—THE STATUS OF *CALLITHRIX LUGENS* (HUMBOLDT) AND *CALLITHRIX AMICTUS* E. GEOFFROY.

By D. G. Elliot, D. Sc., F. R. S. E.

In the 'Annals and Magazine of Natural History' for March, 1914, p. 345, Mr. Oldfield Thomas states that *C. lugens* E. Geoffroy and *C. amictus* E. Geoffroy and *Simia lugens* Humboldt, together with *Saguinus vidua* Lesson are all black bellied species, and are one and the same, but presents no proofs to sustain the position he takes. In determining a species we are generally obliged to rely upon the description given by its author or on his type if existing, and lacking the latter, upon some specimen coming from the type locality if that is known. But should none such specimens be available, and the original description be so brief and unsatisfactory as to make it impossible to decide what the animal really looks like, it is then placed among the undeterminable forms.

In the 'Annals du Museum,' Vol. XIX, 1812, p. 114, E. Geoffroy describes these two monkeys as follows:

"3. Veuve. *Callithrix lugens* (Humboldt).

"Pelage noirâtre; gorge et mains antérieures blanches: queue à peine plus longue que le corps."

This species was described by Humboldt as given below.

"4. C. à fraise. *Callithrix amictus.*

"Pelage brun-noirâtre; un demi-collier blanc; mains de devant jaunes: queue plus longue d'un quart que le corps."

It will at once be noticed that in both descriptions the color of the arms, legs, feet, tail and underparts of the body are not given, and in no other of his publications does E. Geoffroy give any further information of these species. He undoubtedly believed he had two distinct animals before him, and he diagnosed them so as to emphasize their distinctness. However his *lugens* is taken from Humboldt and is blackish, has only a white throat, hands white, and tail nearly as long as the body; while *amictus* is blackish brown, a white half collar, yellow hands, and a tail longer than the body. If *lugens* had a white collar it is inconceivable that neither Humboldt nor E. Geoffroy should not have mentioned it. I could not find the type of *lugens* in the Paris Museum, nor any specimens bearing that name, and I have no recollection of seeing one in any collection. It differs from *amictus* in being without a white collar, having white hands, a tail that is shorter and without the brown hue of the pelage.

The *Simia lugens* Humboldt is described in the Synoptical List as follows:

"*Simia lugens,* atra facie albo-maculata, gula nivea, manibus anterioribus albis, posterioribus nigris."

It will here be also noticed no mention is made of the color of the underparts, but earlier in the volume is a more detailed description; he gives this as "Corpus, cauda, crura et brachia nigra," and in the French description he states "elle a le poil doux, lustré, d'un beau noir et un peu relevé. Ce pelage est *d'une teinte uniforme sur le corps entier* de l'exception de la face du col et des mains de devant."

Here we have an entirely black monkey with a snowy throat and hands white, an animal not represented in any collection at the present time.

Humboldt probably did not know *C. amictus* for he gives only a brief latin description in his Synoptical List evidently founded on the French one of E. Geoffroy, and makes no mention of the species elsewhere in the volume.

C. amictus is a very rare animal in collections. I do not think that I have seen half a dozen examples in the Museums of England and the Continent. It was generally considered by the earlier writers, who probably had never seen a specimen at that time, as *C. torquatus,* and it may be said that if an example of *amictus* has lost the hair on the under side of the body it is not easy to distinguish one from the other. There was one adult specimen in the British Museum, but not in good condition, and it was not until I saw the alleged type in the Paris Museum that I was satisfied that *C. torquatus* and *C. amictus* were distinct. E. Geoffroy states that *amictus* has "mains de devant jaunes," but all the specimens that I saw had white hands. Certainly the hands of the so-called type in the Paris Museum were white, and I do not remember seeing any examples with yellow hands as given by E. Geoffroy. If, therefore, this should affect its specific standing, then the animal now recognized as *amictus* would have to take a new name, and we would be obliged to wait for the appearance of a yellow-handed *amictus.*

Mr. Thomas has brought forward a problem incapable of any satisfactory solution. There are no specimens extant to prove what exactly were the species the two authors described. We have been obliged to drop many from our lists as indeterminable, and *C. lugens* E. Geoffroy and *S. lugens* Humboldt had better go with them. It may have been an error to place *lugens* among the synonyms of *C. torquatus.* It would have been a greater error to state that it was the same as *amictus* (there being no proof whatever to sustain the assertion), and make that name a synonym of *lugens.* It is easy for one to assume anything that occurs to him, but an assumption without facts to support it, is, to say the least, a most unstable foundation upon which to establish a species. Towards the close of his remarks Mr. Thomas assumes that his new species *Callicebus lucifer,* the chief character

of which is a "chestnut rufous tail," is probably the same as Spix's *amictus*, in spite of the fact that Spix's figure shows a black tail, and in his Latin description he writes "caudae sublonge brunneo-nigris," and in the French one "la queue d'un noir luisant." It may be well to state that Lesson's description of his *vidua* is not an original one, but merely founded upon that of Humboldt's *lugens*, and therefore whatever Humboldt's species is (at present unknown), the *vidua* Lesson would be its synonym.

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Article XL.— DIAGNOSES OF APPARENTLY NEW COLOMBIAN BIRDS. III.

By Frank M. Chapman.

Plate XIII, Sketch Map of Southwestern Colombia.[1]

This is the third paper based on the American Museum's recently acquired collections from Colombia. Like its predecessors [2] it contains descriptions of proposed new species and subspecies which are published at this time to secure the types for this Museum and to invite criticism which may be embodied in the final report on our work in Colombia.

Continued study of our now very large Colombian collections has revealed the need of specimens from both Antioquia and eastern Panama, particularly in solving the very complex distributional problems which have arisen as examination of the material at hand progresses. Mr. L. E. Miller has therefore returned to Colombia taking with him Mr. Howarth Boyle, to make a section across the Central and Western Andes from Puerto Berrio on the Magdalena to the Atrato Valley, and to determine the character of the Tropical Zone and its fauna at the northern end of these chains of mountains, and Mr. W. B. Richardson has gone to eastern Panama to make the preliminary arrangements for an expedition to the Espiritu Santo Mountains, on which he will be joined later by Mr. H. E. Anthony.

The explorations of the last-named gentlemen should go far toward ascertaining to what extent the mountains of eastern Panama have served as a connecting link between those of Chiriqui and northwestern Colombia, and in what measure they have separated the streams of life that have flowed into Panama from the east and south.

The satisfactory determination of many of the forms described beyond would not have been possible had not fellow ornithologists promptly and generously met my requests for the loan of specimens for comparison. For such loans I am indebted to Dr. C. W. Richmond of the United States National Museum, Mr. E. W. Nelson of the Biological Survey, Mr. Witmer Stone of the Academy of Natural Sciences of Philadelphia, Mr. Outram Bangs of the Museum of Comparative Zoölogy, Mr. C. B. Cory of the Field Museum, Mr. W. E. C. Todd of the Carnegie Museum, and Mr. Thomas E. Penard of Arlington, Mass.

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[1] Reproduced from Art. XII, this volume.

[2] Bull. Amer. Mus. Nat. Hist., XXXI, July 23, 1912, pp. 139–166; XXXIII, Mch. 19, 1914, pp. 167–192.

As in the preceding papers of this series, I have used the color terms contained in Mr. Ridgway's 'Color Standards and Nomenclature.'

Streptoprocne zonaris altissima subsp. nov.

Char. subsp.— Agreeing in size with *S. z. zonaris* of southern Brazil, but bill heavier, the ridge of the culmen more prominent, general color, particularly of the inner wing-quills and wing-coverts greener, forehead averaging paler, the breast-band broader with the terminal half, rather than the terminal third, of its feathers white, the edge of the wing, as far as the primary coverts and some of the lesser coverts, distinctly margined with white; differs more pronouncedly from *S. z. albicincta* in the characters named, and in its larger size.

Type.— No. 111521, Am. Mus. Nat. Hist., ♂ ad., Laguneta, alt. 10,300 ft., near Quindio Pass, Central Andes, Colombia, Sept. 11, 1911; A. A. Allen and L. E. Miller.

Range.— Temperate (and Alpine?) Zone of the Andes of Colombia and Ecuador southward, doubtless, to northern Argentina.

Remarks.— The discovery that even birds of such exceptional power of flight as the large Swifts may have representative forms in zones separated by a few thousand feet is one of the most interesting results of our studies of zonal distribution in Colombia. *Streptoprocne zonaris albicincta* is distributed throughout the Tropical Zone of Colombia and ascends to at least the lower border of the Subtropical Zone. We have taken it from San Antonio in the Western Andes to Buena Vista in the Eastern Andes, securing in all 16 specimens. The form here described, however, we have taken in Colombia only at Laguneta, in the Temperate Zone (one specimen) and on Mt. Pichincha, Ecuador (3 specimens). The differences between *altissima* and *albicincta* are more striking than those which exist between *zonaris* and *albicincta*. There is no indication of intergradation among our 20 Colombian and Ecuadorian specimens of both forms and it is not probable, in my opinion, that *albicincta* and *altissima* intergrade *inter se*, but that their connectant is true *zonaris*. The intergradation of *altissima* with *zonaris* may reasonably be looked for at some point where increasing south latitude brings the Temperate Zone to the altitude at which *zonaris* occurs, let us say northwestern Argentina, while the intergradation of *albicincta* with *zonaris* may be looked for in that region south of the Amazon where the Amazonian forests merge into or interdigitate with the highlands of southern Brazil.

The proper application of the name *zonaris* must be considered in connection with this proposed new form. In describing his *Hirundo zonaris*

Shaw gave no type locality. As Mr. Ridgway states, however, the type-locality of this form "is assumed to be Brazil," and under this assumption he gives the range of this race as "Southern Brazil and northern Argentina," while the range of *albicincta* is said to be "Northern South America to Costa Rica."[1] This arrangement appears to have correctly expressed our knowledge of the distribution of the South American forms of this species at the time it was written. Nevertheless Brabourne and Chubb (Bds. S. A., I, 1912, p. 102) give only "British Guiana" as the range of *albicincta,* while that of *zonaris* is said to be "Colombia; Venezuela; Ecuador; Peru; Bolivia; Brazil," and they "suggest" "Colombia" as the type-locality of this form. It does not seem to me, however, to be desirable to adopt this suggestion and for the following reasons: (1) As Ridgway has said the type-locality of *zonaris* has heretofore been considered to be Brazil. (2) Ridgway's (*l. c.*) restriction[2] of the name *zonaris* to the form of "Southern Brazil and northern Argentina" antedates Brabourne and Chubb's suggestion. (3) No definite locality in Colombia is named and the presence of two races of *zonaris* in that country makes it uncertain, under their restriction of *albicincta* to British Guiana, to which one they would apply the name *zonaris.* (4) The smaller and heretofore only recognized race from Colombia has already been described as *Hemiprocne minor* by Lawrence and examination of his type, in the American Museum, shows it to be a specimen of the small Tropical Zone bird which Ridgway refers to *albicincta.* I have seen no topotypical (Guiana) specimens of this bird but it is unlikely that they differ materially from those of tropical Colombia. If they do, the Colombian bird may stand as *S. z. minor* without materially affecting the case. (5) It is most unlikely that Shaw, writing in 1796, had specimens of the Swift of the High Andes. I should, therefore, arrange the South American races of *Streptoprocne zonaris* as follows:

1. *S. z. zonaris* (Shaw). Southern Brazil and northern Argentina (Chapada, Matto Grosso, Brazil, proposed as type-locality). Wied's type of "*Hirundo collaris*" agrees with Chapada specimens.
2. *S. z. albicincta* (Cab.). Northern South America (from the southern limits of Amazonia?) to Costa Rica. (Type locality, Guiana.)
3. *S. z. altissima* Chapm. Temperate (and Alpine?) Zone of Colombia and Ecuador, and southward. (Type locality, Laguneta, Central Andes, Col.)

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[1] Bull. U. S. N. M. 50, v, 1911, p. 697.

[2] Such restriction was in effect made by Cabanis in describing (J. f. O., 1862, p. 165) "*Hemiprocne albicincta*" the range of which was said to be from "Mexico to Guiana" while *zonaris* is referred to as "Brazilian."

Measurements of Males.

Locality	Wing	Tail	Tarsus	Culmen	Width of bill at base
S. z. altissima, Laguneta, Col.	212	70.5	25	11	8
" " Pichincha, Ecu.	210	68	25.5	10.5	8
" " " "	212	67.5	25.5	11.5	8
" " " "	215	73	25	11	8
S. z. zonaris, Chapada, Matto Grosso, Brazil	212	71	25.5	11	7.5
" " " "	212	70	25.5	10	7
" " " "	210	70	25.5	10	7.5
S. z. albicincta, Las Lomitas, Col.	196	71	20	9	6
" " San Antonio, "	200	65	21.5	9	7
" " Chicoral, "	201	67	20.5	10	7
" " Quetame, "	193	69	22	10	7
" " Buenavista, "	200	73	21	9	6.5
" " Villavicencio, "	205	74	23.5	9.5	7.5

Trogonurus curucui cupreicauda subsp. nov.

Char. subsp.— Male most nearly resembling *T. curucui curucui* [1] but exposed upper portions of six inner tail-feathers rich copper-bronze (as in *T. ambiguus*), in some specimens with, in others without, greenish reflections; bars of three outer pairs of tail-feathers wider, as in *T. c. tenellus;* wing-coverts more broadly barred; no white evident at the junction of green breast with orange abdomen; resembles *T. c. tenellus* in the barring of the outer tail-feathers and wing-coverts, but differs in its copper-bronze tail, absence of white pectoral band, and more deeply colored abdominal region.

Female most like *T. c. curucui* but wing-coverts apparently more widely barred; the abdomen more deeply colored than in *T. c. tenellus,* the wing-coverts more broadly barred, the breast, at junction of brown and orange, without, or with but slight indication of the conspicuous white or grayish pectoral band.

Type.— No. 123,271, Am. Mus. Nat. Hist., ♂ ad., Bagado (alt. 1000 ft.), Choco, Colombia, Sept. 25, 1912; Mrs. E. L. Kerr.

Range.— Tropical Zone of the Pacific coast of Colombia, south to Western Ecuador [2] (?); east to the Magdalena Valley.

Remarks.— Of this well-marked race we have the following specimens: Baudo (2500 ft.), 1 male ad., 1 female, ad.; Bagado (1000 ft.), 1 male ad.; Juntas de Tamaná, 1 female ad.; San José, 1 male im.; Barbacoas, 2 males ad., 2 males im., 2 females ad.; west of Honda, 1 female ad.

While the last-named specimen agrees closely with others from the Pacific coast, the extension of the range of this form to the Magdalena Valley

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[1] *Cf.* Ridgw., Bull. U. S. N. M., 50, V, 1911, p. 764.
[2] *Cf.* Salvad. & Festa, Boll. Mus. Tor., XV, 368, p. 317.

would be more satisfactory if based on males. *Trogon atricollis,* however, is recorded by Sclater and Salvin (P. Z. S., 1879, p. 535) from Remedios and Neche in Antioquia, and the faunal affinities of this and the Pacific coast region would lead us to believe that the form here described was common to both.

For the same reason it seems probable that the bird recorded by Salvadori and Festa (*l. c.*) from the Rio Peripa in western Ecuador is also referable to *cupreicauda.*

Of true *curucui* we have four males and a female, all adult from British Guiana, while *T. c. tenellus* is represented by the following specimens: Panama R. R., 3 males ad., 2 females, ad.; Boruca, Costa Rica, 1 male ad., 2 males, im., 1 female, ad.; Ottiro, C. R., 1 male, ad.; Matagalpa, Nicaragua, 2 males, ad.; Chontales, Nic., 1 male, ad.; Rio Grande, Nic., 1 male ad.

I am in doubt as to the identity of an adult male from La Murelia in the Caquetá region. It has the tail more coppery than in the most extreme specimen of *cupreicauda,* there is a more evident white pectoral band, and the wing-coverts are less broadly barred, but in other respects it agrees with the Pacific coast bird.

Chrysotrogon caligatus columbianus subsp. nov.

Char. subsp.— Resembling *C. c. caligatus* (Gould) of Central America in the vermiculation of the wings and feathering of the tarsus, but with the head blue or purplish as in *C. violaceus* (= *meridionalis*) and *C. ramonianus;* size, particularly of bill, smaller than in allies.

Type.— No. 121664, Am. Mus. Nat. Hist., ♂ ad., Opon, Central Magdalena River, Colombia, Jan. 27, 1913; Geo. K. Cherrie.

Range.— Tropical Zone of Colombia between the Western and Eastern Andes, (Honda, Opon, Puerto Berrio, Santa Marta, Remedios, Antioquia; Naranjo, near Bucaramanga).

Remarks.— Colombian specimens of this species have heretofore been referred to *caligatus,*[1] but the five adult males in our collection have the blue or purplish, which in true *caligatus* is confined to the nape, extended forward to the forehead or at least to a point opposite the center of the eye. They therefore agree in this character with average specimens of *violaceus* but in other respects except size, including the feathering of the tarsus, are like *caligatus.*

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[1] Wyatt, Ibis, 1871, p. 374 (Naranjo, alt. 2500 ft., near Bucaramanga); Sclater and Salvin, P. Z. S., 1879, p. 535 (Remedios, alt. 2360 ft., Antioquia); Allen, Bull. A. M. N. H., XIII, 1900, p. 135 (Cagualito, Minca, Santa Marta; specimens in Am. Mus.); Ridgway, Bull. U. S. N. M., 50, V, p. 789 (20 miles w. of Honda; specimen in Am. Mus.).

Not one specimen in our series of males of *caligatus* from Yucatan, southern Mexico, Nicaragua, Costa Rica, Panama (including the type of *T. concinnus* Lawr.), and Esmeraldas, Ecuador, has the bluish of the nape so developed anteriorly as in any of the Colombian specimens which, therefore, cannot be properly referred to the Central American and west Ecuadorian form. It should be noted that *caligatus* has not as yet been recorded form the Pacific coast of Colombia.

It will be observed that the proposed new form to some extent bridges the gap between *caligatus* and *violaceus* and in spite of the differences in the feathering of their tarsi it seems not improbable that these two forms will be found to intergrade. As the appended measurements show there is less difference in size between specimens from Nicaragua and Ecuador than there is between those from the Caribbean Coast of Colombia at Santa Marta and the Magdalena Valley. The Santa Marta birds, however, are geographically interposed between Panama and Trinidad, while the Magdalena River form (true *columbianus*) is an isolated offshoot removed from the direct line of geographical intergradation.

Measurements of Males.

Locality	Wing	Tail	Bill from Nostril
Nicaragua	120	123.5	12.0
"	118.5	121.	12.
"	117.5	126.5	11.5
Panama R. R.	112.5	121.5	11.5
"	110.5	115.0	11.5
Esmeraldas, Ecuador	116.7	119.0	11.
" "	113.	115.5	12.5
" "	110.5	117.0	12.0
Santa Marta, Colombia	117.0	127.5	11.
" " "	114.5	120.5	10.5
Magdalena River	105.5	114.	10.0
" "	110.5	118.0	10.0
" "	104.5	114.5	10.5
Trinidad	117.0	115.	12.0
"	116.	113.5	12.
"	112.5	117.5	12.5

Eubucco bourcieri occidentalis subsp. nov.

Capito bourcieri (nec Lafr.) Scl. & Salv., P. Z. S., 1879, p. 538 (Frontino, Antioquia).

C[apito] salvini (nec Shelley) Dalmas, Bull. Soc. Zool. France, 1900, p. 180 (Las Cruces = San Antonio, Col.).

Capito bourcierii salvini (nec Shelley) Hellm., P. Z. S., 1911, p. 1199 (Loma Hermosa, R. Jamaraya, Pueblo Rico, Col.).

Eubucco bourcieri æquatorialis (part, nec Salvad. & Festa) Ridgw. Bull. U. S. N. M., 50, VI, p. 315 (northwestern Colombia).

Char. subsp.— Similar to *E. b. salvini* but more richly colored and averaging larger; red of throat slightly deeper and more clearly defined or more sharply contrasted with the tawny orange of the breast, this last-named color deeper and of greater extent both laterally and posteriorly; flanks and abdomen appreciably yellower.

Type.— No. 107955. Am. Mus. Nat. Hist., ♂ ad., San Antonio (6600 ft.), Western Andes, above Cali, Colombia, Jan. 6, 1911; W. B. Richardson.

Remarks.— After comparison of six adult males from San Antonio with fifteen from western Panama and Costa Rica I cannot follow Hellmayr and Dalmas in referring the west Colombian bird to the form found in Chiriqui and Costa Rica. The differences between males from these two regions have already been pointed out by Ridgway who, in default of specimens from Ecuador, referred west Colombian birds to *æquatorialis.* The latter, however, as shown by two males in our collection from Gualea and Rio de Oro, western Ecuador, is a quite different form without tawny orange on the underparts.

With the race which Ridgway has wrongly identified as *shelleyi,* and for which I below propose the name *orientalis,* the west Colombian bird requires comparison. Among other differences, however, the male of *occidentalis* has the sides of the breast tawny orange, not sulphur yellow, while the female lacks the blue frontlet of the east Ecuadorian bird.

Eubucco bourcieri orientalis subsp. nov.

Eubucco bourcieri shelleyi (nec Dalmas) Ridgw., Bull. 50, VI, U. S. N. M., 1914, p. 315.

Char. subsp.— Similar to *E. b. salvini* but male with the sides of the breast sulphur-yellow; female with the posterior margin of the black frontlet blue.

Type.— No. 129576, Am. Mus. Nat. Hist., ♂ ad., Zamora (2000 ft.), Prov. Loja, eastern slope of Andes, Ecuador; Nov. 5, 1913; W. B. Richardson.

Remarks.— After an examination of the type, Hellmayr (P. Z. S. 1911, p. 1200) has shown that *Capito shelleyi* Dalmas (Bull. Soc. Zool. France, Nov. 1900, p. 179) is based not on the bird of the Napo region, as Dalmas erroneously believed, but on the bird of western Ecuador, which Salvadori and Festa (Boll. Mus. Zool. Torino, XV, 368, Feb. 1900, p. 22) had already described as *Capito æquatorialis,* and of which, therefore, *shelleyi* is a synonym.

Ridgway (*l. c.*) misled by the locality given by Dalmas, and lacking specimens of *æquatorialis,* has identified a 'Napo' skin of *orientalis* in the American Museum as *shelleyi,* but in doing so states that it has the breast tawny-orange, and in this respect does not agree with Dalmas' description.

'Quito' skins, like those from Bogotá, are usually without definite locality and may come from either the Amazonian (Napo) or Pacific (Gualea, Nanegal, etc.) slope of the Andes.

Salvadori and Festa, and Hellmayr have shown that the form from western Ecuador is "immediately recognizable by the crimson of the throat and foreneck being abruptly contrasted with the clear sulphur-yellow belly without any orange tinge" (Hellm.) and their observations are confirmed by two males collected by Richardson at Gualea and Rio de Oro, Manavi, respectively. Three females collected by Richardson at Gualea and one at Naranjo, Prov. Guayas, further show that in *æquatorialis,* as in *salvini* and *occidentalis,* this sex has the frontlet black without a posterior band of blue. On the other hand, three females of *orientalis,* collected by Richardson at Zamora, the type-locality, have a blue band at the posterior margin of the frontlet. The case seems to be complicated by Dalmas' (*l. c.* p. 180) statement that the female of *shelleyi* has the "front terminé d'une bande bleuatre." Here again, however, the inaccurate or indefinite data accompanying native-made skins has led to incorrect conclusions, and it is evident that Dalmas after describing as *Capito shelleyi,* a male which he believed to have come from the Napo region but which, as Hellmayr has shown, represents the form of the Pacific slope, referred to his proposed new species a female which actually did come from the Napo region, but which in truth belongs not to "*shelleyi*" but to the race for which I have suggested the name *orientalis.*

In spite of its close resemblance to *E. b. salvini,* its distribution and the coloration of the female indicate that the relationships of *orientalis* are actually with *E. b. bourcieri,* the only form of this bird inhabiting the Eastern Andes of Colombia, whence we have specimens from as far south as Andalucia and San Agustin. The females of *bourcieri* and *orientalis* agree and differ from the other members of the group in having a blue band on the forehead, while the male of *orientalis* has the sides of the breast sulphur-yellow as in *bourcieri.* In the male of *bourcieri,* however, the red of the throat extends over the breast to the abdomen and there is little or no tawny orange on the underparts, while in *orientalis* the amount and disposition of red and tawny orange below is much as in *salvini.*

If I have correctly determined the specimens in our collection the following forms of *Eubucco bourcieri* may be recognized:

1. *Eubucco bourcieri salvini* (Shelley). Subtropical Zone in Costa Rica and western Panama.
2. *Eubucco bourcieri occidentalis* Nob. Subtropical Zone of the Western Andes of Colombia.
3. *Eubucco bourcieri æquatorialis* (Salvad. and Festa). Subtropical and upper border of the Tropical Zones of the Pacific slope of the Ecuadorian Andes.

4. *Eubucco bourcieri bourcieri* (Lafr.). Subtropical Zone of the eastern slope of the Central Andes and western slope of the Eastern Andes of Colombia.

5. *Eubucco bourcieri orientalis* Nob. Subtropical and upper border of the Tropical Zone of the Atlantic slope of the Ecuadorian Andes.

Measurements of Males.

	Locality	Wing	Tail	Culmen
E. b. salvini	Chitra, Chiriqui	71	48	19
" "	" "	69.5	45	19
" "	Boquete, "	73	50	19
" "	" "	67	—	19
E. b. occidentalis	San Antonio, Col.	75.5	51	21
" "	" " "	75	50	20
" "	" " "	76	51	19
" "	Lomitas "	75.5	51	20
E. b. æquatorialis	Gualea, Ecuador	74	51	21
" "	Rio de Oro, "	75	49.5	21
E. b. bourcieri	San Agustin, Col.	72.5	50	19
" "	La Palma, "	73	51	17.5
" "	Andalucia, "	74	49	19
E. b. orientalis	Zamora, Ecuador	71	50	17.5
" "	" "	72	51	18
" "	" "	69	50	18

Chrysoptilus punctigula striatigularis subsp. nov.

Char. subsp.— Differs from all other described forms of *Chrysoptilus punctigula*, except *C. p. uhjelyi*, in having the throat white streaked with black instead of black spotted with white; differs from *C. p. uhjelyi* in being darker, with the spots below, particularly on the flanks, larger, the upperparts and wings with clearly defined broad black bars (much narrower and nearly obsolete, dorsally, in *uhjelyi*); differing from *C. p. punctipectus* in the pattern of the throat, as described above, in being browner above and in having the spots of the underparts larger, more numerous, and extending to the flanks and abdominal region.

Type.— No. 108291, Am. Mus. Nat. Hist., ♀ ad., Cali, 3500 ft., Cauca Valley, Colombia, May 11, 1911; L. E. Miller.

Range.— Tropical Zone of Colombia west of the Eastern Andes and south of the semi-arid Caribbean coastal region.

Remarks.— The occurrence of *Chrysoptilus punctigula punctipectus* in the Tropical Zone of the eastern slope of the Eastern Andes and of *C. p. striatigularis* in this zone on the western slope of the same range brings both forms into the Bogotá region and hence into 'Bogota' collections. In default of proper data their well-marked racial differences have evidently been considered to represent individual variations and we have therefore an additional illustration of the confusion wrought by the use of unlabeled skins from a region containing at least two distinct faunas and double the number of zones.

Our specimens of *striatigularis* are from the following localities:

Near Honda, 1; Puerto Berrio, 2; Rio Frio, 1; Cali, 2; Noanamá, 1.

The last-named specimen, a male, has the throat and cheeks tinged with yellow; and the red of the crown extending to the base of the bill and nearly concealing the black of the anterior portion of the crown. These markings may indicate high plumage rather than racial variation since a male of *uhjelyi* has the crown similarly colored.

Thanks to the National and Field Museums and to Mr. T. E. Penard, I am in possession of specimens topotypically representing all the recognized forms of *Chrysoptilus punctigula*, the characters and distribution of which may be summarized as follows:

1. *Chrysoptilus punctigula punctigula* (Bodd.). Throat black, each feather with two subterminal, rounded white spots, upperparts antique-brown; size small; male, wing, 105; tail, 61; culmen, 22.5 mm. Parimaribo, Surinam, 3 specimens (Penard).
2. *C. p. punctipectus* Cab. & Hein. Throat as in *punctigula* but back much greener, nearly warbler-green; underparts paler; larger, male, wing, 112; tail, 69; culmen, 23 mm. Venezuela, Cumana, 1; (Field Museum); lower Orinoco, 1; Colombia, Barrigon, 1; Villavicencio, 2; Buena Vista, 1.
3. *C. p. guttatus* (Spix). Described from the river Amazon. I assume that this form is represented by two specimens from Santarem (Nat. Museum) and three from northeastern Peru (Moyobamba, Huallaga; Field Museum). These five birds appear to be inseparable and in general coloration and the markings of the throat they do not differ materially from the Paramaribo specimens. They are, however, larger (wing, 109; tail, 68, culmen, 23 mm.), but so far as the material at hand goes this difference in size is not sufficient to warrant the recognition of an Amazonian race.
4. *C. p. uhjelyi* Madar. A pale form from the Caribbean coast region of Colombia with the throat white striped with black, the bars of the upperparts broken, narrow and dorsally almost obsolete; male, wing, 105; tail, 63, culmen, 23. Santa Marta, 1; Calamar, 1; near Cartagena, 1.
5. *C. p. striatigularis* Chapm. With characters and range as above; male, wing, 110; tail, 68; culmen, 23.5.

It will therefore be seen that my conclusions in regard to the forms of *Chrysoptilus punctigula* are at variance with those presented by Hellmayr (Abhandl. Akad. Wiss. 1906, p. 607) who refers specimens from northeast Peru, Bogotá collections, Barranquilla and Cartagena to *C. p. speciosus* (Malh.) a name which I believe to be a synonym of *guttatus* (Spix), and of the validity of this latter form I am by no means convinced.

Veniliornis oleaginus aureus subsp. nov.

Char. subsp.— Similar to *V. o. fumigatus*, but back richer, more golden, auricular region averaging paler, wing averaging shorter, bill longer; resembling *V. o. sanguinolentus* in general color but wings and their coverts externally with less golden wash and more as in *fumigatus;* white spots on wing-quills larger, the short outer primary usually showing trace of white, the second (from without) primary with three instead of two white spots; size, larger.

Type.— No. 116143, Am. Mus. Nat. Hist., ♂ ad., La Sierra (6800 ft.), Central Andes south of Popayan, Colombia, March 2, 1912; A. A. Allen and L. E. Miller.
Range.— Subtropical Zone of Western Andes and western slope of Central Andes of Colombia southward into Ecuador.

Remarks.— This form is in large measure an intermediate between *V. o. fumigatus* and *V. o. sanguinolentus.* In the golden coloration of the back it agrees with the latter, but the wings and their white markings are as in the former; in size it is nearer *fumigatus* but the bill averages longer, and the wings shorter.

Of *sanguinolentus* I have an excellent series of nine specimens from Nicaragua; of the proposed new form fourteen specimens from throughout the range given, and of *fumigatus* ten from the Bogotá region taken by ourselves, a female from Inca Mine, southeastern Peru and a male from Yungas, Bolivia. The two specimens last-named may be considered typically to represent *fumigatus* and, so far as they go, they indicate that our specimens from the vicinity of Fusugasugá, in the heart of the Bogotá region, may be referred to that form.

Measurements of Males.

Locality	Wing	Tail	Culmen
San Rafael del Norte, Nicaragua.	85	48	20
" " "	90	53	21
" " "	90	48	20
Salencio, W. Andes, Colombia.	93	52	21
Las Lomitas, " "	96	53.5	21
San Antonio, " "	94	50	22
Popayan "	98	54.5	22.5
La Sierra, Cen. Andes, Colombia.	101	57	23
La Candela, " " "	99	57	20
San Agustin, " " "	97	55	21
Fusugasugá, E. " "	99	51	20
Yungas, Bolivia	100	52	20

Measurements of Females.

Locality	Wing	Tail	Culmen
Rio Coc, Nicaragua	87	51	20
" " "	89	—	20
Las Lomitas, W. Andes, Col.	94	54	20
San Antonio, " "	95	54	21
" " "	97	54	22
Popayan "	95	51	21.5
Miraflores, Cen. Andes, "	98	56	21
La Candela, " " "	102	57	20.5
Fusugasuga, East. " "	99	58	20
" " " "	102	—	21
Enconosa " " "	100	57	20
Inca Mine, Peru	96	52	20

Thamnistes anabatinus intermedius subsp. nov.

Char. subsp.— Similar to *T. a. coronatus* [1] Nels. but upperparts, wings and tail darker, the crown between russet and argus-brown instead of cinnamon-brown, and more distinctly defined from the back, the back with a russet tinge, the tail hazel rather than cinnamon-rufous.

Type.— No. 117805, Am. Mus. Nat. Hist., ♀ ad., Barbacoas, Colombia, Sept. 6, 1912; W. B. Richardson.

Remarks.— This form, based on but one specimen, is clearly an intermediate between *T. æquatorialis* of eastern Ecuador and southeastern Colombia, and the quite different *T. anabatinus* group of Panama to Mexico. Its crown and back closely agree in color with those of *æquatorialis* while the underparts are similar to those of *T. a. coronatus;* the tail and wings externally are intermediate but nearer to those of *coronatus.* Being forms of the Tropical Zone the ranges of *æquatorialis* and *intermedius* are apparently separated by the Andean system, but the near relationships of *æquatorialis* and *anabatinus* are indicated by the discovery of this southwest Colombian race. North of Barbacoas, *Thamnistes* has not been recorded from Colombia. If its range is not interrupted, its intergradation with *coronatus* is assured. Of the latter race I have the five specimens to which Mr. Nelson referred in his description of it showing that it ranges from eastern to western Panama. Its intergradation with the Costa Rican *T. a. saturatus* is evidently proven by a specimen from Calobre, Veragua, which has the rufescent back of *saturatus* and the rufous crown of *coronatus,* as well as by a specimen, showing intermediate characters, from Paso del Pital, Rio Naranjo, Costa Rica. Three other Costa Rican specimens differ so slightly from two from Mexico that, so far as this material is concerned, one questions the desirability of recognizing a Costa Rican form. Ridgway refers the rufous-capped Calobre, Veragua specimen to *saturatus* (Bull. U. S. N. M., 50, V, p. 24; see also Nelson, Smiths. Miscell. Coll. 60, 3, p. 10) and it is evident from his description that in separating a form under the name *saturatus* he was influenced by the characters exhibited by this specimen.

Myrmopagis schisticolor interior subsp. nov.

Char. subsp.— Male like the male of *M. s. schisticolor* (Lawr.), female very different from the female of that race, the back slate-gray, not brownish or buffy olive, the crown grayer, the tail and wings grayish margined externally with olivaceous instead of russet; size somewhat larger.

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[1] Smiths. Miscell. Coll., 60, No. 3, 1912, p. 10.

Type.— No. 121897, Am. Mus. Nat. Hist., ♀ ad., Buena Vista (alt. 4500 ft.), east slope Eastern Andes, above Villavicencio, Colombia, March 3, 1913; F. M. Chapman.

Range.— Subtropical zone of the eastern slope of the Central Andes and of both slopes of the Eastern Andes in Colombia, and eastward through the Tropical Zone to the Orinoco.

Remarks.— A series of 38 females and 45 males covering the greater part of the range of *Myrmopagis schisticolor,* satisfactorily shows the characters and indicates the range of the forms of this species. *Myrmopagis s. schisticolor* (Lawr.) extends from western Ecuador (Zaruma) northward to Guatemala. In Colombia it ranges as far eastward as the western slope of the Central Andes and occupies the Subtropical Zone. I can distinguish no racial differences in our series of 19 females and 27 males of this form. In the male the black below extends well down the breast and in some cases centrally reaches the abdomen. The females have the upperpart essentially concolor; the head averages browner than the buffy olive back but is never clearly defined from it. There is much variation in the intensity of color of the underparts but it appears to be individual.

Myrmopagis s. sanctæ-martæ (Allen)[1] inhabits the Caribbean Coast region from at least Santa Marta eastward to northeastern Venezuela. A male from Tumatumari, British Guiana, and another from the Mt. Duida have no more black on the throat than the type of *sanctæ-martæ* but are somewhat paler and have the rectrices lightly tipped with white.

The female of *sanctæ-martæ* (= *Hylophilus brunneus* Allen, Bull. A. M. N. H., XIII, 1900, p. 171, Los Nubes, Santa Marta) agrees in general with the female of *schisticolor,* but our specimens have the front more ochraceous. A female from Cristobal Colon at the extreme eastern point of the Paria Peninsula, is somewhat grayer than two from Santa Marta, but the difference is well within the range of individual variation shown by our series of *schisticolor.* I have no females from British Guiana but one from Suapure, and another from the Mato River in the Lower Orinoco, show in their grayer backs a decided approach toward *M. s. interior,* while three females from the foot of Mt. Duida are even nearer that form.

So far as females are concerned it seems apparent, therefore, that the area of intergradation between *sanctæ-martæ* and *interior* is in the Orinoco region. This supposition is supported by the fact that males of *interior* from Buena Vista have, as a rule, less black on the breast than males of true *schisticolor.*

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[1] *Myrmotherula sanctæ-martæ* ALLEN, Bull. A. M. N. H., XIII, 1900, p. 160 (Valparaiso. Santa Marta. Type in Am. Mus.); consult also Hellmayr and Seilern, Archiv. für Naturg., 1912, p. 124.

While, as just remarked, males from Buena Vista have less black on the breast than most specimens of *schisticolor,* the race is to be distinguished only by the female, which has the back and rump slate-gray clearly defined from the grayish olive head, and is thus strikingly different from the female of either *schisticolor* or *sanctæ-martæ.*

To the eastward *interior* evidently intergrades with *sanctæ-martæ* or an undescribed form of it. Females from the foot of Mt. Duida are nearer *interior,* but a male from the same place is nearer *sanctæ-martæ.*

Our collection contains specimens from the following localities:

Guatemala, 1 female; *Nicaragua,* 6 females, 10 males; *Costa Rica,* Boruca, 1 female; *Panama,* Chiriqui, 2; *Colombia;* Las Lomitas, 2 males; San Antonio, 3 males; Ricaurte, 1 male; Miraflores, 2 males, 1 female; *Ecuador;* Esmeraldas, 1 female; Rio de Oro, 5 females, 2 males; Naranjo, 2 males, 1 female; Santa Rosa, 1 male; Zaruma, 3 males, 2 females; *Colombia;* Santa Marta, 2 males, 2 females; *Venezuela;* Las Palmales, 1 male; Cristobal Colon, 2 males, 1 female; *British Guiana;* Tumatumari, 1; *Venezuela;* Suapure, 1 female; Mato River, 1 female; foot of Duida, 1 male, 3 females; *Colombia;* Buena Vista, 6 males, 6 females; La Murelia, 1 female; Aguadita above Fusugasugá, 1 male; La Palma, 1 male, 1 female; La Candela, 1 male, 3 females.

Microrhopias grisea hondæ subsp. nov.

Char. subsp.— Very closely related to *M. g. alticincta* Bangs of San Miguel Island, Panama Bay, but upperparts in both sexes slightly paler, browner, less fuscous; the female differing in the color of the upperparts from the male of *M. g. grisea,* much as it does from the male of *alticincta* but the longer rectrices without or with but faint white tips; the female, like the female of *M. g. grisea, unspotted below,* but with the upperparts slightly paler, the underparts very much paler, white faintly tinged with light buff, except on the throat, instead of rich ochraceous-buff.

Type.— No. 111914, Am. Mus. Nat. Hist., ♀ ad., Chicoral (alt. 1800 ft.), upper Magdalena Valley, Colombia, Oct. 8, 1911; A. A. Allen and L. E. Miller.

Remarks.— The material at my command indicates the specific distinctness of the Caribbean coast region representative of this group, hitherto known as *Microrhopias* (= *Formicivora*) *grisea intermedia.* Males of this form differ from those of *M. g. grisea* from British Guiana chiefly in having a larger and whiter superciliary, but females are strikingly unlike these of *M. g. grisea, M. g. hondæ,* and *M. g. alticincta* in having the jugulum and breast with large central black areas which are partly concealed by the whitish margins of the feathers. This character is well shown by our series of 34 females from the following localities: Bonda, Santa Marta, 29; Puerto Cabello, Ven., 1; San Antonio, Bermudez, Ven., 1; Cristobal Colon, Ven., 3.

In the female of the race which I should call *Microrhopias intermedia orenocensis* (Hellm.), of which we have five topotypical specimens, the

breast is even more strongly spotted than in *M. i. intermedia.* On the other hand, not one of our eight specimens of *hondæ* from the upper Magdalena, shows the slightest indication of spots, nor are these marks present in *alticincta* (*cf.* Thayer and Bangs, Bull. M. C. Z., XLVI, 1905, p. 150) or in any of the specimens of *grisea* which I have examined.

In Colombia, *M. g. hondæ* appears to be known only from the upper Magdalena Valley whence we have eleven specimens from near Honda, seven from Chicoral, and one from Andalucia (alt. 3000 ft.) near the head of the valley. A 'Bogotá' female is referable to this form and Sclater's description (Cat. B. M. XV, p. 250) of the female of *intermedia* as "nearly pure white beneath" indicates that he had in hand a specimen of *hondæ* rather than of *intermedia.*

Berlepsch (J. f. O., 1884, p. 308) states that Bucaramanga specimens agree with those from Bogotá but are perhaps smaller, hence we may believe that his specimens are also referable to *hondæ.*

Beyond these records, the form in which the female is unspotted below appears to be unknown to the westward until we reach San Miguel Island in Panama Bay, whence Bangs has described *Formicivora* (= *Microrhopias*) *alticincta* (Proc. N. E. Zool. Club, III, 1902, p. 71). In spite, however, of the geographic isolation of this race I should rank it as a subspecies under the name *Microrhopias grisea alticincta.* While intergradation by contact is, under the circumstances, impossible, this form is so near *hondæ,* that I believe intergradation by individual variation is possible.

To the eastward *hondæ* appears to be separated from *grisea* by the spotted breasted *M. i. intermedia* and *M. i. orenocensis* with which it is not known to intergrade. Possibly these intervening forms may actually cut it off from *grisea,* when if it does not merge into *intermedia* the upper Magdalena form would stand as *Microrhopias alticincta hondæ.*

Hylopezus dives barbacoæ subsp. nov.

Char. subsp.— Similar to *H. d. dives* Salv., but crown darker, its color extending little if any on to the back, which is dark olivaceous rather than slaty; back, as a rule, without fulvous shaft-streaks, exposed margins of the wing-quills averaging less cinnamomeus, dresden-brown rather than tawny.

Type.— No. 117883. Am. Mus. Nat. Hist., sex?, Barbacoas, Nariño, Colombia. Sept. 8, 1912; W. B. Richardson.

Remarks.— This is evidently an intermediate between *H. d. dives* and *fulviventris* from the eastern base of the Eastern Andes. It is based on four specimens from the type-locality and one from San José, W. Colombia, which have been compared with a single specimen of *fulviventris* from La

Murelia and eight of *dives* from Nicaragua. In *fulviventris* the back is more purely olivaceous and it is furthermore, easily distinguished by whitish lores.

There is no geographical reason why *dives* and *barbacoæ* should not intergrade, but *fulviventris* is effectually isolated from the latter by the intervening Andes.

Mr. Ridgway has proposed for *Grallaria dives* and other allied species the genus *Hylopezus* (*cf.* Bull. U. S. N. M., 50, V, p. 152), but the characters assigned to it appear to be shared in part by certain of the smaller species of *Grallaria* and it is possible that *Hylopezus*, with certain other recently proposed genera, should be accorded subgeneric rather than generic rank.

Synallaxis azaræ media subsp. nov.

Char. subsp.— Most closely resembling *S. a. azaræ* d'Orb., of Bolivia and southeast Peru, but underparts generally paler, abdomen, particularly, whiter, flanks grayer, frontal band grayer and wider. Similar to *S. a. elegantior* Scl., of the restricted Bogotá region, but lores gray, not white, postocular stripe grayish olive not pale ochraceous-buff; underparts less white, the breast gray, not white, with or without a faint grayish wash; throat showing more black, flanks and under tail-coverts grayish olive rather than buffy olive; back averaging more ochraceous.

Type.— No. 112055, Am. Mus. Nat. Hist., ♀ ad., Salento (7000 ft.), Central Andes, Colombia; Sept. 27, 1911; A. A. Allen and L. E. Miller.

Range.— Upper parts of the Subtropical and lower part of the Temperate Zone (7000 to 10,500 ft.) in the Western and Central Andes of Colombia and southward into Ecuador (Pichincha).

Remarks.— With 53 specimens of this group from Colombia and Ecuador before me, I have no difficulty in recognizing two well-marked forms. Their distribution, however, is peculiar and its satisfactory explanation requires a more intimate knowledge of local climatic conditions than I possess.

Four 'Bogotá' skins and five adults from Chipaque about 12 miles east of Bogotá, and two specimens from Merida, Venezuela, agree in characters and obviously represent *S. a. elegantior* (Scl.). While this bird may be a representative form of *frontalis* Pelz., it appears to me to be too unlike that species to stand as a geographic race of it. From *frontalis* (of which we have 24 specimens from Chapada, Matto Grosso) it differs in having a more graduated, much longer tail (95 as compared with 79 mm.), with more pointed rectrices, paler coloration throughout, an ochraceous-buff postocular stripe, and a longer bill (12.5 instead of 11 mm.). In size and in the form of the tail *elegantior* more closely resembles the geographically farther removed *ruficapilla* Vieill., than it does *frontalis*. It also possesses, though in a less developed degree, the ochraceous-buff postocular stripe of that species

but differs from it in its olive-gray instead of chestnut-rufous front, less rufous back and whiter underparts.

Two of our Matto Grosso specimens of *frontalis* have practically the entire crown, including the forehead, chestnut-rufous as in *ruficapilla*, nevertheless the differences between them, particularly in the form and size of the tail, seem to indicate their specific distinctness.

The comparatively short tail and rounded remiges of *frontalis* in addition to well-marked color characters, make it difficult to believe that it intergrades with *azaræ* d'Orb. of Bolivia and southeastern Peru. Of this form I have two specimens from Inca Mine, Peru, and one[1] from Yungas, Bolivia. They have the underparts and sides of the head between mouse- and deep mouse-gray, the flanks washed with the brownish olive of the back the throat blackish tipped with gray and the buffy postocular stripe is wanting. This bird, therefore, differs conspicuously from *elegantior* in color; but in size, in the length of bill and tail, and shape of rectrices the two birds agree and, so far as specimens are concerned, the evidence at hand strongly indicates their intergradation through the race for which I have here proposed the name *Synallaxis azaræ media*.

Of *media* we have thirty specimens from the Central and Western Andes, as listed below, and three from the vicinity of Quito. The characters distinguishing this form from *azaræ* and *elegantior* have already been given. Its intergradation with the latter is indicated by a specimen from La Candela at the head of the Magdalena Valley in which a suggestion of the buffy postocular stripe is present and which, furthermore, is comparatively pale below.

Although I have no specimens of *media* from south of Quito intergradation of that form with *azaræ* is indicated by their general close resemblance. In fact, *media* more nearly resembles the Bolivian *azaræ* than it does the Colombian *elegantior*, with which its intergradation seems to be proven.

It might be expected then, that specimens from south of Quito would be intermediate between *media* and *azaræ*, but the whole case is greatly complicated and the distributional problem much involved by the fact that seven specimens from Zaruma (6000 ft.), one from Loja (7000 ft.), and one from Naranjo (2000 ft.) in southern Ecuador, are all clearly referable to *elegantior* of Bogotá! It is sufficiently surprising to find in this group identical forms occupying the Temperate Zone in the Bogotá region and the Tropic Zone near Guayaquil, but the case is rendered still more puzzling by the occurrence between these points of another form with which, at least from the north, intergradation with the first-named form appears to be proven.

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[1] Type of *Synallaxis griseiventris* Allen (Bull. A. M. N. H., 1889, p. 91) said by Berlepsch (Proc. Int. Cong., 1905, p. 363), on the authority of Hellmayr, to be the same as *S. azaræ*.

The status, in this connection, of *S. fruticicola* Tacz. I am unable to determine, but the description "*Striga postoculari flavicanti-cervina*" (Tacz. P. Z. S., 1879, p. 670) in connection with other characters indicates its close affinity with *elegantior;* indeed Sclater's reference of "an authentic specimen of *S. fruticicola*" (Cat. B. M. XV, p. 40) to *frontalis* (not of Pelzen) suggests that possibly they are the same.

The case is unusual and its satisfactory treatment requires far more material than is now at my disposal. As a contribution towards its solution I append a list of the localities at which our specimens were taken.

Synallaxis azaræ elegantior.

Venezuela: Culata (near Merida), 1; near Merida, (alt. 9700 ft.), 1; *Colombia:* Chipaque (9000–9500 ft.), 6; 'Bogotá' skins, 3; *Ecuador:* Loja (7000 ft.), 1; Zaruma (7000 ft.), 7; Naranjo (2000 ft.), 1.

Synallaxis azaræ media.

Colombia: El Eden (8300 ft.), 6; above Ibague (7000 ft.), 1; Laguneta (10,300 ft.), 3; Salento (7000 ft.), 5; Miraflores (6600 ft.), 4; La Candela (6500 ft.), 2; La Palma (5500 ft.), 3; Valle de las Pappas (10,000 ft.), 7; Cerro Munchique (8300 ft.), 6; *Ecuador*, vicinity of Quito, 3.

Synallaxis mœsta obscura subsp. nov.

Char. subsp.— Similar to *S. m. mœsta* Scl. but darker throughout, the upperparts browner, the white streakings of the throat more restricted, the remainder of the underparts nearly one color, the breast of the same olivaceous shade as the sides and flanks instead of being grayer, the abdomen with little or no grayish.

Type.— No. 116367, Am. Mus. Nat. Hist., ♂ ad., La Murelia, R. Bodoquera, alt. 600 ft., Caquetá, Colombia, July 12, 1912; L. E. Miller.

Remarks.— This race, based on the comparison of two specimens from La Murelia with eleven topotypical specimens of *S. m. mœsta*, exhibits the darker coloration incident to the comparatively more humid region of southeastern Colombia. Evidently it ranges southward along the base of the Andes since Sclater (Cat. B. M., XV, p. 41) records "*Synallaxis mœsta*" from Sarayacu, Ecuador.

Synallaxis gujanensis columbianus subsp. nov.

Char. subsp.— Similar to *S. g. gujanensis* (Gm.), but the forehead grayer the underparts much whiter, the breast very faintly tinted with grayish instead of strongly washed with warm buff; the sides and flanks rather warm grayish olive instead of tawny olive; auricular region grayer.

Type.— No. 121987, Am. Mus. Nat. Hist., ♂ ad., Buena Vista (alt. 4500 ft.), Colombia, March 7, 1913; F. M. Chapman.

Remarks.— This form, founded on thirteen specimens from Buena Vista and Villavicencio, is the palest, just as *S. g. inornata* (Pelz.) is the most highly colored race of *S. gujanensis*. The Guiana, North Brazil, and southern Venezuela representative of the group (two specimens from Surinam, Penard Coll., and one from La Union, Caura, Venezuela) is in a measure intermediate between the two but is nearer *columbianus*. Only the throat and center of the belly are white or whitish in this form, while in *columbianus* the underparts are largely white the breast being slightly, if at all tinged with smoke-gray while the sides and flanks are grayish olive. *Synallaxis g. inornata* (seven specimens Urucum, Matto Grosso; San Lorenzo, R. Madeira, Roosevelt Expd.) as Hellmayr has shown (Nov. Zool., XIV, 1907, p. 13) has only the throat white, the rest of the underparts being ochraceous-buff, paler on the center of the abdomen. The back, in this race, is much more ferruginous than in either *gujanensis* or *columbianus*. The latter have the back alike in color but in *gujanensis* the crown, though perhaps slightly more olivaceous, is nearly concolor with the back, while in *columbianus* the forehead is distinctly grayer than the crown and back.

Synallaxis rutilans caquetensis subsp. nov.

Char. subsp.— Similar to *S. r. amazonica* Hellm., but the rufous areas much deeper (mahogany-red rather than cinnamon-rufous) less extensive below and more extensive above, where they occupy most of the crown and back; flanks and abdominal region olive-fuscous with a slight tint of the color of the breast, rather than buffy brown.

Type.— No. 116376, Am. Mus. Nat. Hist., ♂ ad., Florencia (alt. 1000 ft.) Caquetá, Colombia, June 27, 1912; L. E. Miller.

Remarks.— This very strongly marked race is based on three specimens from the type-locality. They have been compared with three topotypical specimens of *amazonica* (from Santarem) and four of *rutilans* from near Mt. Duida and Suapure, Venezuela. The most important characters of the proposed new form are its rich mahogany red color and the extent to which this color spreads over the back. In a female the entire foreback and scapulars are mahogany red of the same color as the breast, and the crown is similarly colored except for a brownish olive tinge on the hindhead.

The type is similarly colored but has slightly more olive on the back and less on the hindhead; the rump and upper tail-coverts are blackish.

The third Florencia specimen is immature. The mahogany red, though not quite so intense, is spread uniformly over the head and back with but slight traces of olive-brown, the breast has considerably less mahogany red and, correspondingly more olive-brown than in the adult.

Synallaxis pudica caucæ subsp. nov.

Char. subsp.— Similar to *S. p. pudica* Scl., but the crown paler, cinnamon-rufous rather than chestnut-hazel; the back mouse-gray without the olivaceous wash of *pudica*, the rump and upper tail-coverts deep grayish olive, paler than in *pudica*.

Range.— Cauca Valley, Colombia.

Type.— No. 108942, Am. Mus. Nat. Hist., ♂ ad., La Manuelita (alt. 3500 ft.) near Palmira, Cauca Valley, Colombia; April 11, 1911; F. M. Chapman.

Remarks.— This, the palest of the three forms of *Synallaxis pudica*, is apparently confined to the Cauca Valley. The characters on which it is based are shown by six adult specimens taken at or near the type-locality. Ten adult specimens from the Magdalena Valley (San Agustin, Andalucia, Fusugasugá and Anolaima) represent true *pudica*, while 17 from the Pacific coast of Colombia (upper Atrato to Barbacoas) and a series from western Ecuador, I refer to *S. p. nigrifumosa* Lawr. This form is typically represented by three specimens from Nicaragua and two from Costa Rica. It is more richly colored throughout than *pudica;* the crown and the wings, basally and externally, are deeper, more chestnut, the back darker, more olivaceous, the underparts more sooty gray.

The west Colombian birds are to some extent intermediate between *nigrifumosa* and *pudica*. The back and underparts are not quite so deep in most specimens as they are in *nigrifumosa* but the crown and wings agree closely in color with that of the Nicaragua and Costa Rica specimens. In short, the form of the west Pacific coast, as might be expected, is nearer the Central America than it is to the Bogotá race. It follows then, that the race of the Cauca Valley is less like the race to which it is geographically nearest than it is to the form east of the Central Andes. This, however, is merely another way of stating that the climatic conditions of the Cauca Valley are less like those of the Pacific coast than they are like those of the Magdalena Valley.

Sclerurus mexicanus andinus subsp. nov.

Char. subsp.— Above closely resembling *S. m. mexicanus* but with the chestnut of the rump area averaging slightly darker and more restricted; below tawny-rufous of throat paler, more restricted and more sharply contrasted in color with the abdominal region which is more olivaceous, less rufous in tone than in *mexicanus;* outer margins of wing-quills less rufous than in *mexicanus*, the quills themselves darker, the outer web of the primaries differing but little from the inner; the tail longer.

Type.— No. 122059, Am. Mus. Nat. Hist., ♀, Buena Vista (4500 ft.) above Villavicencio, Eastern Andes, Colombia; F. M. Chapman.

Remarks.— This form is based on four specimens from the type-locality for comparison with which I have two birds from Mexico (Jalapa and Orizaba) and three from Loma del Leon, Panama. These specimens from Panama (loaned me by Mr. Bangs) appear to be essentially typical though the occurrence of the species near sea-level and within range of the darker form of *mexicanus* (*S. m. pullus*) is surprising.

Since the proposed new form so nearly resembles true *mexicanus* above, comparison with neither *pullus* nor *obscurior* is necessary.

Measurements.

Locality	Sex	Wing	Tail	Tarsus	Culmen
Jalapa, Mex.	♀	79	57.5	21.5	24.5
Orizaba, "	?	80	56	20.3	24.5
Panama	♂	79	55	22	23
"	♂	79	51	22	24
"	♂	81	54	23	23.5
Buena Vista, Col.	♀	79	60	23	25
" " "	♀ ?	79	59.5	23	24
" " "	?	84	62	23.5	24.5

Pipra leucocilla[1] **minor** subsp. nov.

Char. subsp.— Similar to *Pipra leucocilla anthracina* (Ridgw.) but much smaller, the lower tail-coverts not always tipped with grayish. Wing, 54; tail, 22.5–25; culmen, 8–9; breadth of bill at nostril, 4–5 mm.

Type.— No. 109842, Am. Mus. Nat. Hist., ♂ ad., Cocal (alt. 4000 ft.), Andes west of Popayan, Colombia, June 10, 1911; W. B. Richardson.

Measurements of Males.

Name	Locality	Wing	Tail	Culmen	Width of Bill at Posterior margin of Nostril
P. l. minor	*Cocal, Col.*	54	25	9	5
" " "	" "	54	23.5	9	4
" " " (Type)	" "	54	22.5	8	4
P. l. anthracina,	Guayabo, Costa Rica	62	29	10	5.5
" " " (Type)	Moravia, " "	62	27	10.3	6
" " "	Veragua, Panama	60	27	9	5
" " "	" "	60	25	10	5.7
" " "	" "	59	25	10	5.3
P. l. coracina	Buena Vista, Col.	64	28	9	5.7
" " "	" " "	69.5	30	—	5

Remarks.— The differences in size between two Costa Rican specimens of *Pipra leucocilla* and three from Cocal, Colombia, appear to be sufficiently

[1] For a statement of the claims of this specific name over that of *pipra* see Berl. & Hart., Nov. Zool., IX, 1902, p. 53.

great to warrant the separation of the Cocal form on the basis of size alone. Veragua specimens, as might be expected show an approach toward the west Colombian form. Between Veragua and Cocal no representative of this species seems to have been recorded.

Two of the Cocal birds have the lower abdomen as well as the under tail-coverts tipped with grayish. The third has these parts black with no trace of grayish. It thus resembles *P. l. coracina* in color but is distinguished from that race, as it is from *anthracina*, by its small size.

Manacus manacus interior subsp. nov.

Char. subsp.— Resembling *M. m. abditivus* in color but wing and tail averaging slightly longer, the wing more pointed, the chin feathers ('beard') shorter, broader, and less stiffened; differing from *M. m. manacus* in its grayer underparts, unbarred nape and more pointed wing.

Type.— No. 122373, Am. Mus. Nat. Hist., ♂ ad., Villavicencio, Colombia, Mch. 9, 1914; George K. Cherrie.

Range.— Interior of northern South America from the lower Orinoco to the base of the Andes and southward into Amazonia.

Remarks.— The identification of our specimens of the small group to which this form belongs was expected to be a comparatively simple matter, but greatly to my surprise I have found it necessary to describe as new all three races contained in our recently acquired collections from Colombia and Ecuador.

The characters distinguishing the races of *Manacus manacus* appear not to have been fully understood. But the excellent series now at my command enables me to ascertain the limits of individual variation and I can therefore determine what variations are truly racial.

For example, the adult male of *Manacus manacus manacus* (Linn.), for which we may certainly accept Surinam as type-locality (*cf.* Bangs, Proc. N. E. Zool. Club, I, 1899, p. 34) has invariably been described as having a white nape, whereas only two of my 19 adult male specimens are without more or less fine black barring on this area or on the post-auricular region. This character is not shown by any of the 49 adult males of the other forms of the group, but it is shown in an exaggerated degree by Edwards's figure (Edwards, pl. 260) on which the name *manacus* is based. This gray-naped form ranges at least from Cayenne to Trinidad. We have adult males from the following localities: Cayenne, 1 (the bars are more highly developed in this than in any of the other specimens); Para, Surinam, 4; Paramaribo, Surinam, 1; Demarara, British Guiana, 1; Wismar, British Guiana, 4; Rockstone, British Guiana, 3; Princestown, Trinidad, 4.

Specimens from Trinidad have slightly larger bills than those from Surinam, but I am unable to see any other difference in size and none in color. The characters attributed to *M. m. trinitatis* (Hart.) (Bull. B. O. C., XXIX, 1912, p. 311) are not therefore supported by our specimens.

It is somewhat surprising to note, however, that while Trinidad birds agree in color with topotypical examples of *manacus*, the abdominal region being fully as white in the latter as in the former, five specimens from Rockstone on the Essequibo River, and three from Wismar on the Demarara River, are decidedly grayer below than those from Surinam and Trinidad. These British Guiana birds were taken in September while the Surinam and Trinidad series was taken in March and April, and it is possible that the differences in color shown may be seasonal. The British Guiana as well as the Surinam and Trinidad birds, have the nape or postauricular region, or both, with the fine blackish bars which appear to characterize *manacus;* and all possess a more rounded wing than any other form in the group, except *gutturosus* (see measurements beyond).

As remarked in the diagnosis, *M. m. interior* (of which we have 5 adult and 1 immature males and 2 females from Maripa or lower Orinocan Venezuela, and 1 adult male and 2 females from Villavicencio) resembles *M. m. abditivus* in color, the abdominal region being decidedly grayer than in true *manacus*, but it differs from that race in averaging slightly larger and in having a more pointed wing, and, chiefly, in having the chin-tuft softer, shorter and broader. Our excellent series of 14 topotypical adult males of *abditivus* show that in this form the feathers of the chin range from 17 to 22 mm. in length and are not only longer but narrower and somewhat stiffer than in any of the other races. This feature is shown by two native skins from Antioquia, to which region we may therefore extend the range of *abditivus*. It is especially interesting to observe that in this character of elongate chin-plumes *abditivus* resembles the very differently colored *M. vittellinus* of Panama and that portion of western Colombia from which no race of *manacus* has been recorded.

Southward of Antioquia we have found no representative of *Manacus manacus* until we reach Barbacoas in southwestern Colombia, where occurs a well-marked race for which I propose the name

Manacus manacus bangsi subsp. nov.

Char. subsp.— Resembling *M. m. gutturosus* (Desm.) in color, the throat and jugulum white clearly demarked from the deep gull-gray breast and abdomen, but wing longer and more pointed, tail shorter, outer primaries narrower less regularly curved and projecting 8 to 10 mm. beyond the tips of secondaries.

Type.— No. 118038, Am. Mus. Nat. Hist., ♂ ad., Barbacoas, Nariño, Colombia, Aug. 24, 1912; W. B. Richardson.

Remarks.— So far as color is concerned this new form (of which we have 3 males and 4 females all from Barbacoas) requires comparison only with *M. m. gutturosus.* It agrees with that race, and differs from all other described races, in having the breast and abdomen comparatively deep gray clearly defined from the white jugulum and throat. In *gutturosus,* however, the tail is long the wing short and rounded, while the longest primaries do not extend more than 5 mm. beyond the secondaries in the closed wing. Furthermore, the outer primaries are broader and are regularly curved or falcate from base to tip, whereas in *bangsi* as well as in the remaining members of the group, the 'curve' is more angular, the feathers being boomerang-shaped rather than falcate.

It gives me pleasure to name this well-marked race for Mr. Outram Bangs in recognition of his numerous and important contributions to our knowledge of Tropical American birds, including a review of the group to which it belongs.

Manacus manacus bangsi appears to have a very restricted range. No representative of this species has been recorded from the west coast of Colombia north of Barbacoas nor have we met with one in the Cauca Valley. To the south it can extend but a few miles since, much to my surprise, the form of *Manacus manacus* occurring in Western Ecuador, from at least Esmeraldas to Santa Rosa, is quite different. It has been referred by various writers, with or without comment, to *Manacus gutturosus* or *abditivus* but our excellent series (8 adult and 4 young males; 5 females) plainly shows that it possesses distinctive characters and I propose for it, therefore, the name

Manacus manacus leucochlamys subsp. nov.

Chiromachæris manacus (nec Linn.) Scl., P. Z. S., 1860, p. 279 (Babahoyo), p. 296 (Esmeraldas); Berl. & Tacz. P. Z. S., 1883, p. 559 (Chimbo); Hartert, Nov. Zool., V, 1898, p. 488 (Paramba, Chimbo, Cachavi); Salvad. & Festa, Boll. Mus. Tor., XV, 1899, No. 362, p. 15 (part; Rio Peripa).

Char. subsp.— In the whiteness of the underparts resembling *M. m. manacus*, but differing from that form in its shorter tail, more pointed wing, much wider, unbarred white nuchal area and narrower black dorsal band.

Type.— No. 118799, Am. Mus. Nat. Hist., ♂ ad., Esmeraldas, Ecuador, Oct. 19, 1912; W. B. Richardson.

Range.— Tropical Zone of western Ecuador from at least Esmeraldas to Santa Rosa.

Remarks.— The width of the white nuchal band, or 'cape,' which distinguishes this race has been previously commented on (*cf.* Berl. and Tacz. *l. c.*) but lack of sufficient material has evidently heretofore made it difficult to determine whether this character was individual or racial. Comparison

of our nine adult males with 58 adult males representing other forms of the group shows that the characters given above are at all times diagnostic. The posterior extension of the nuchal band, without regard to the manner in which the skin is prepared, so reduces the black dorsal band that in none of the specimens examined does it exceed 15 mm. in width while in some it measures only 10 mm. across. In other races of *manacus* it is apparently never less than 20 mm. in width and averages about 25 mm.

The only specimen I have seen from eastern Ecuador (Zamora) is closely related to the form for which I have proposed the name *M. m. interior.*

According to my interpretation of the material examined the races of *Manacus manacus* may be determined by the characters given in the following key:

Key to Males of Manacus manacus.

I. Under tail-coverts white.................. *M. m. purus* (Santarem, Brazil).
II. Under tail-coverts gray.
  1. White of nape usually more or less marked with fine blackish bars.
     M. m. manacus (Guianas, Trinidad).
  2. White of nape without bars.
    A. Abdominal region distinctly and uniformly gray clearly defined from white breast and throat.
      a. Tail under 30 mm.; primaries extending at least 8 mm. beyond secondaries........... *M. m. bangsi* (Southwestern Colombia).
      b. Tail over 30 mm.; primaries extending less than 6 mm. beyond secondaries.................. *M. m. gutturosus* (East Brazil).
    B. Abdominal region more or less white, at least anteriorly, not clearly defined from white breast.
      a. Nuchal band broad reaching to nearly middle of back, black dorsal band averaging less than 15 mm. wide.
         M. m. leucochlamys (W. Ecuador).
      b. Nuchal band narrower, not reaching to middle of back; black dorsal band wider than 15 mm.
        a′. Breast and belly whiter, throat plumes longer, stiffer and narrower............. *M. m. abditivus* (North Colombia).
        b′. Breast and belly grayer, throat plumes softer, and shorter.
           M. m. interior (Orinoco region, E. Colombia; ?E. Ecuador).

Measurements of Males.

Name	Locality	Wing	Tail	Primaries beyond Secondaries
M. m. gutturosus	Bahia, Brazil	47	32	5
" " "	San Paulo	49.5	34	3.5
" " "	Minas Geraes	47	34.5	4.5
M. m. manacus	Cayenne	52	31	5
" " "	Surinam	49	30	5
" " "	"	47	28	4

Measurements of Males.— (*Continued*).

Name	Locality	Wing	Tail	Primaries beyond Secondaries
M. m. manacus	Surinam	51	30	5
" " "	"	51	33	5.5
" " "	Demerara	52	31	5.
" " "	Wismar, Brit. Guiana	50	31	6
" " "	" "	50.5	32	5
" " "	Rockstone, " "	52	32	6
" " "	Princestown, Trinidad	51	31.5	6
" " "	" "	50	32	6
" " "	" "	51	31	5.5
" " "	" "	51	33	6
M. m. interior	Maripa, Venezuela	53	31	9
" " "	" "	52	31.5	8
" " "	" "	52	30	9.5
" " "	" "	52	30.5	9
" " "	" "	53	30	9
" " "	Villavicencio, Col.	54	31	8.5
" " "	Zamora, Ecuador	53	31.5	9
M. m. abditivus	Minca, Santa Marta, Col.	53	29.5	7
" " "	" " " "	52	29.5	8
" " "	Cagualito, " " "	51.5	31	7
" " "	" " " "	50.5	29	7
" " "	Don Diego, " " "	49.5	30	6
" " "	Bonda, " " "	52	29.5	7
M. m. bangsi	Barbacoas, Col.	53	27	10
" " "	" "	50	25.5	8.5
" " "	" "	51	27	9
M. m. leucochlamys,	Esmeraldas, Ecuador	51.5	27	8
" " "	" "	52	27.5	12
" " "	" "	51	25	10
" " "	" "	52	26.5	10
" " "	Rio de Oro "	51	27	8.5
" " "	" " "	52	27.5	11.5
" " "	Santa Rosa "	53	28.5	9.5

Pachyrhamphus castaneus saturatus subsp. nov.

Char. subsp.— Similar to *P. c. intermedius* Berl., but much darker throughout; the back deep hazel, or between amber brown and argus brown, the underparts ochraceous tawny, the nape slate-gray; the crown of nearly the same shade as the back.

Type.— No. 116760, Am. Mus. Nat. Hist., sex?, La Murelia, (alt. 600 ft.) Caquetá, Colombia; L. E. Miller. Wing, 73; tail, 54; tarsus, 17; culmen, 13 mm.

Remarks.— Although I have but a single specimen of this proposed race, its characters are so pronounced that I do not hesitate to describe it. Mr.

Todd has loaned me three essentially topotypical specimens of *P. c. intermedius* from Aroa, northern Venezuela, and I have three specimens of *castaneus* (Jard. & Selb.) (= *rufus* Auct. not of Bodd.) and this material shows, as might be expected, that the relations of *saturatus* are with the former rather than the latter. It presumably agrees with *intermedius* in size, the measurements of the type being approximately those of a female from Venezuela. The much paler colors of *intermedius* are such as might be expected in a bird from the comparatively arid Caribbean slopes of northern Venezuela, while the intense, deep colors of *saturatus* are a natural accompaniment of the humid forest region in which the type was taken. The crown in *intermedius* is noticeably darker than the back, but in the type of *saturatus* it is of essentially the same color and is restricted in area posteriorly by the encroachments of the slate gray nuchal band. The latter character, however, may be only individual.

Two specimens recorded by Chubb (Ibis, 1910, p. 604) from Sarayacu, Ecuador, may belong to the form here described, but a specimen from La Paz, Bolivia, in our collection (No. 30747, Rusby Coll.) is nearer to *intermedius* than to *saturatus*. Doubtless it represents an undescribed race.

Pachyrhamphus magdalenæ sp. nov.

Char. sp.— Resembling *P. cinnamomeus* but much paler, the back browner, less rufous, sayal brown rather than rufous-tawny; the crown-cap more clearly defined from the back, the wing-coverts much browner and with pronounced lighter margins; the underparts white washed with warm buff; the bill smaller, the mandible browner.

Type.— No. 122383, Am. Mus. Nat. Hist., ♂ ad., Algodonal, Magdalena River, Jan. 23, 1913, George K. Cherrie.

Description of Type.— Crown deep hazel, clearly defined from the much less rufous back of sayal brown; rump and upper tail-coverts brighter more tawny than the back; tail rich tawny or pale rufous tawny, the feathers somewhat lighter at the tip, the shafts of essentially the same color as the vanes, the outer feather 12.5 mm. shorter than the longest; outer wing-quills fuscous narrowly margined with mikado brown externally, except at the end; inner quills largely cinnamon to sayal brown, the inner webs of primaries and secondaries margined basally with pale cinnamon increasing in extent and richness inwardly; wing-coverts light cinnamon-brown tipped and externally edged with pale cinnamon; under wing-coverts cinnamon-buff; lores pale gray, supra-loral line whitish, well-defined and reaching from the nostril to the back of the eye; auricular region pale cinnamon-buff; underparts pale buffy, washed in places with pale cinnamon-buff; thighs cinnamon-buff; under tail-coverts pale buffy; feet dark plumbeous; maxilla blackish, mandible fuscous-brown. Length (skin), 142; wing, 76.5; tail, 55.5; tarsus, 20.5 culmen, 13 mm.

Remarks.— This species is based on a single adult male (the correct sexing of which is confirmed by the presence of the short ninth primary)

in fresh, unworn plumage. Its specific distinctness from *P. cinnamomeus* is indicated by the circumstance that the range of *cinnamomeus* appears to surround that of *magdalenæ*, and also by the fact that the much paler coloration of *magdalenæ* cannot be attributed to climatic conditions since the type was taken in the heavily forested, humid portion of the Magdalena Valley.

Euchlornis riefferi occidentalis subsp. nov.

Char. subsp.— Similar to *E. r. riefferi* but head, throat and breast blacker, the black of the head more sharply defined from the green back; closely resembling *E. r. melanolæma* in the color of the parts named but the wing-coverts and tertials less conspicuously tipped, black areas of these feathers less clearly defined and differently shaped.

Type.— No. 108271, Am. Mus. Nat. Hist., San Antonio (alt. 6600 ft.), Western Andes, Col., Jan. 25, 1911; W. B. Richardson.

Remarks.— At first glance our series of 26 specimens of this form from the Western Andes appeared to be referable to the Venezuelan form *melanolæma*, which it resembles in the blackness of the head and neck, but a closer examination reveals well-marked differences which are summarized in the preceding diagnosis. Stated in detail, the greater wing-coverts in *melanolæma* are black, bordered externally and apically with green which, near the tip of the outer border, is itself margined with yellow. The black area is sharply defined and, except at the tip, occupies all the inner vane and more than half the outer vane of the feather. In *occidentalis* (as well as *riefferi*) the black area is smaller and less sharply defined; in some specimens it is confined to the inner vane of the feather or if it extends to the outer vane it narrows toward the tip and thus makes the black area sharply pointed apically. A somewhat similar but more striking difference is seen in the tertials which in *melanolæma* have the black area larger and more strongly marked, occupying all the inner vane of the feather and a continuous strip of varying width along the shaft on the outer vane. The tertials in this form are, therefore, black margined externally with green and tipped with white, whereas in *occidentalis* (as well as *riefferi*) the outer web is largely green and if the black of the inner web extends to it, it occupies only a narrow area which does not reach the white terminal band. This band, as well as the yellow margin on the greater coverts, averages wider and more conspicuous in *melanolæma* than in *occidentalis* and *riefferi*. In short, *occidentalis* possesses the head and neck of *melanolæma* and the wing-pattern of *riefferi*. While the differences distinguishing these forms are rather difficult of exact definition, they are well-marked and readily appreciated when specimens are compared.

The characters presented by the greater-coverts and tertials are equally well shown by both sexes, and the female of *melanolæma* appears to have the marking of the breast and sides more squamate than in *occidentalis* or *riefferi.* Females of the last two, however, cannot be distinguished.

The range heretofore attributed to *melanolæma* has never seemed to be in accordance with the laws usually governing the distribution of geographic races. I find, for example, that a specimen from Gualea, Ecuador has the black head and breast of the Venezuelan bird to which it would doubtless be referred if one did not recognize the characters which characterize the bird here described as *occidentalis.* As a matter of fact the Gualea bird agrees with the West Andean form and it is not improbable that other specimens from Ecuador and Peru, which have heretofore been called *melanolæma,* should be known as *occidentalis.* The former, therefore, should properly be restricted to the Venezuelan Andes.

In addition to the 26 specimens of *occidentalis* our collection contains 17 topotypical specimens of *riefferi* from the Bogotá region and seven specimens of *melanolæma* from Merida, Venezuela. Two males from El Eden, in the Central Andes, have the breast as green as in *riefferi* but the crown somewhat darker than average specimens of that form to which, however, they should be referred.

Pyroderus scutatus occidentalis subsp. nov.

Char. subsp.— Similar to *P. s. orenocensis* (Lafr.) but abdominal region and under wing-coverts darker, hazel rather than cinnamon-rufous or Sanford's brown, ventral region, thighs and lower tail-coverts blacker, upperparts, wings and tail blacker and more glossy, the margins of the feathers more iridescent, frontal feathers longer and softer and showing no tendency to form a frontal crest. Differing from *P. s. masoni* Ridgway in having the brown of the abdominal region paler, deep hazel rather than chestnut-bay, and more extensive.

Type.— No. 109074, Am. Mus. Nat. Hist., ♀ ad., San Antonio, alt. 6600 ft., W. Andes, Colombia, April 7, 1911; F. M. Chapman and W. B. Richardson.

Remarks.— In Western Colombia this by no means uncommon bird is restricted to the heavy forests of the Subtropical Zone in both the Western and Central Andes, where it ranges from an altitude of 5000 to 7500 feet. This fact led me to believe that Lafresnaye's type, said to have come from "l'embouchure de l'Orénoque," was in reality collected in the mountains of Venezuela. Thanks, however, to the kindness of Mr. Outram Bangs, the Museum of Comparative Zoölogy has loaned me Lafresnaye's type, while through the courtesy of Mr. W. E. Clyde Todd, the Carnegie Museum has sent me a specimen of *Pyroderus* actually collected at Altagracia, on the Orinoco, by M. A. Carriker, Jr., June 8, 1910.

When it is remembered that Lafresnaye's type was secured about 1846,

and for the greater part of the time since that date has been mounted and on exhibition, it is not only in excellent condition but is practically identical with the fully adult male collected by Carriker. The cinnamon-rufous of the abdominal region is slightly paler in the type than in the Carnegie Museum bird, but aside from this, the birds are essentially alike. Both have the grayish black ventral region and lower tail-coverts, and both have the upperparts of the same comparatively dull, lustreless black, and the frontal feathers stiff and more or less produced into a median crest.

It seems, therefore, fair to assume that Lafresnaye's type did come from the Orinoco, and also that it still typically represents the form for which it stands. The amount of red in the breast-shield shows both birds to be fully adult, while measurements indicate that the type, like the Altagracia bird, is a male. The underparts, from the posterior margin of the breast-plate quite to the ventral region, are uniform cinnamon-rufous, except for a narrow blackish area on each side of the breast-patch.

For comparison with these two Orinoco birds I have 23 specimens from the mountains of the Cauca region all of which, aside from differences due to age, are most uniform in color and hence agree in possessing the characters which readily separate the proposed new race from true *orenocensis*.

So far as *P. s. orenocensis* is concerned, therefore, the case is clear and the Carnegie Museum specimen both confirms the locality and the character of the type. Let us now consider *Pyroderus masoni* Ridgw.

Thanks to Dr. C. W. Richmond, the National Museum has sent me the type and 'co-type' of this bird. Both were attached to some ethnological specimens from South America, the exact locality being unknown. Both are immature. The type lacks a tail, one wing, the primaries of the other, the feet and terminal third of the bill. The second specimen agrees with the first in condition but lacks part of the abdominal feathers of the right side. It, however, possesses a tail. These specimens agree in having the abdominal region deep chestnut-bay, a darker color than that of any specimen in our entire series. The fact that the skins are not stuffed makes it difficult to determine accurately their pattern, but it is obvious that the chestnut color is not so continuous as in *orenocensis* and *occidentalis,* and the black mark which is present on each side of the breast in the last-named forms appears to cross the breast in *masoni.*

Evidence which indicates that this richly colored race inhabits eastern Peru is supplied by Mr. Louis Agassiz Fuertes. Mr. Fuertes has in his possession a Peruvian Indian girdle which was presented to him by Mr. A. F. Larco, of Trujillo, Peru, to which is attached a portion of a skin of *Pyroderus.* That this girdle came from Peru is beyond question, though the exact locality is unknown. It can, however, have come only from the Amazonian slope.

The fragment of skin in question has been loaned me by Mr. Fuertes. It is of an adult and consists of head, neck, throat and anterior part of the back and breast. Fortunately enough of the breast is present to show that in the depth of the chestnut color of this part the bird agrees with *masoni* rather than with *orenocensis* or *occidentalis.* It also resembles the type of *masoni* in the richness of the basal color of the red-tipped throat feathers which are apically deeper in shade than in the other two brown-bellied forms. A further point of resemblance is shown by the extension of the black marks present in each side of the breast in *orenocensis* and *occidentalis* to form a nearly complete band across the lower breast. In short, this fragment from Peru appears to be undeniably referable to *P. s. masoni,* which consequently we may believe to inhabit eastern Peru.

In this connection it is important to recall that Taczanowski (Orn. du Pérou, II, p. 392) records *Pyroderus granadensis* from the "Montanas del Mayro (Coll. Raimondi)" on the Amazonian slope of the Peruvian Andes at about s. lat. 10°. It is obvious, however, from Taczanowski's description — "Pectore abdomineque rufis; fascia pectorali crissoque nigris"— that he had a bird of the *orenocensis* type rather than of the black-bellied *granadensis* form. His reference to a black band on the breast is also significant, since it appears to describe a character shown by the type and cotype of *masoni,* and the Peruvian fragment I refer to that form.

In the more detailed description following the diagnosis the underparts are given as "roux brunatre, avec une bande noire a travers la poirtrine." The facts in the case, therefore, all strongly point toward Peru being the home of *Pyroderus scutatus masoni.* It seems probable, however, that the bird is by no means common since beyond the record of Taczanowski, I find no other mention of the occurrence of *Pyroderus* in Peru.

I have seen too little material from the mountains of Venezuela to determine the status of the forms of *Pyroderus* in that region. A fully adult male taken by Carriker in the Cumbre de Valencia, and loaned me by Mr. Todd, has the brown of the underparts darker and much less extensive than in *orenocensis.* Possibly it may be regarded as an intermediate between the brown-bellied and black-bellied races. The rufous appears only on the lower breast and upper abdomen and is there largely confined to the median area.

A specimen from Merida, Venezuela, is clearly referable to *granadensis,* though the few brown tips to several feathers on the centre of the breast are paler than in Bogotá specimens of that bird. In the Bogotá region proper we secured but one specimen of *granadensis,* taken south of Fusugasugá. We have also two specimens of this race from San Agustin and La Palma at the head of the Magdalena Valley.

In addition to the specimens above mentioned, von Berlepsch (J. f. O., 1884, p. 306) records *granadensis* from Bucaramanga, and Wyatt (Ibis, 1871, p. 334) from Canuto (alt. "about 6000 ft.") north of the city of Bucaramanga. Although P. s. "*orenocensis*" is recorded from "Bogotá" it is probable that 'Bogotá' skins of this form are from Antioquia and hence should be referred to *occidentalis*. This is true of a skin labelled "Bogotá" in our collection.

If it be true, as the records indicate, that *granadensis* is the only form occupying the Eastern Andes of Colombia, then we have this race geographically interposed between the brown-bellied races, *orenocensis* of Venezuela and *occidentalis* of western Colombia. Add to this the wide gap in the range of *P. s. scutatus*, of southeast Brazil and Paraguay, and its northern representative *P. s. granadensis*, of the Andes of Eastern Colombia and Western Venezuela, and the fact that no form of this genus has yet been recorded from Ecuador, though it is known from Peru, and we have a singularly perplexing problem in distribution.

Our series of *P. s. occidentalis* shows no sexual difference in color, but adult males can usually be distinguished by their larger size. Immature birds are much smaller than adult ones. A table of measurements is appended.

Table of Measurements.

Locality	Sex and Age	Wing	Tail	Tarsus	Bill Length from Nostril	Bill Breadth at Nostril
San Antonio, W. Andes	♂ ad.	250	145	48	27	16.3
" " "	♂ ad.	235	145	47	26.5	17
" " "	♂ ad.	254	154	49	26.5	15
" " "	♂ ad.	250	148	47.5	27	15
La Florida, "	♂ im.	228	153	42	27.5	16
" " "	♂ im.	232	147	40.5	26	16.7
El Roble, Cen. Andes	♂ ad.	250	156	45	29	15
" " " "	♂ ad.	245	151	44	28.5	16
Salento, " "	♂ im.	242	157	44	30	15
Las Lomitas, W. Andes	♀ im.	225	154	43	26	15
San Antonio, "	♀ ad.	220	140	41	26	15
" " "	♀ ad.	225	143	40	25.2	15.4
" " "	♀ ad.[1]	235	142	41.5	26	14.5
" " "	♀ ad.	230	142	41	28	15.5
Cerro Munchique, W. Andes	♀ ad.	225	146	40	25	14
Miraflores, Cen. Andes	♀ ad.	226	145	41	28	15.3
" " "	♀ ad.	224	143	41	26	16
" " "	♀ ad.	225	144	39	25.5	13
"Orinoco"	ad. ♂ ?[2]	242	148	46	26	14
Altagracia, Orinoco, Venezuela	♂ ad.	238	151	44.5	29.5	15

[1] Type of *occidentalis*.
[2] Type of *orenocensis*.

Cistothorus apolinari sp. nov.

Char. sp.— Similar to *Cistothorus æquatorialis* (Lawr.) but very much larger, feet particularly larger and heavier, color throughout paler, the dorsal streaks and bars in tail and wings broader; the outer pair of rectrices unbarred; outer margin of three outer primaries unbarred, wing quills much broader.

Type.— No. 130590. Am. Mus. Nat. Hist., ad., Suba Marshes (alt. 8600 ft.) four miles from Bogotá, Colombia, February 7, 1914; Hermano Apolinar Maria.

Description of Type.— Crown uniform Saccardo-umber, the feathers so colored nearly to their bases; lores dusky, a barely evident buff postocular line, a rather obscure postocular mark slightly darker than the crown; anterior part of nape to rump black with broad whitish and light buff shaft-streaks; rump brighter than crown, tawny-olive, the feathers gray basally and with no indication of concealed markings; upper tail-coverts like rump but with a faint suggestion of blackish bars; tail much like rump, or a little darker, the central feathers with distinct and broad black bars which become fainter on the next to the outer pair, outer feathers unbarred and with small or no trace of black markings; wing-quills fuscous, the outer margin of the three outer primaries, pale buffy unbarred, the buff on the outer margin of remaining quills becoming deeper in color inwardly and with black bars or marks which cross both webs of the tertials; underparts unbarred, washed with tawny olive, strongest on the sides and flanks and under tail-coverts, the throat and median line to the vent paler; feet pale brownish; bill brownish black, the mandible whitish horn.

Description of Juvenal Plumage.— Two immature birds taken at the type locality January 19, 1913, differ from the adult in having the crown deep fuscous, the back cinnamon-brown with obscure blackish markings and faint buffy streaks barely wider than the shafts of the feathers; the brownish areas of wings and tail, sides and flanks, are deeper, more cinnamon, the white of the throat and belly is clearer and more extensive, the maxilla is straw-yellow; the outer tail-feathers and outer margin of the third primary, from without, are barred.

Remarks.— So far as I am aware no form of the genus *Cistothorus* has been recorded from the Bogotá region. Hellmayr has described a species (*Cistothorus platensis meridæ*) from Merida, Venezuela, but no other species of this genus appears to be known until one reaches southern Colombia where *Cistothorus æquatorialis* Lawr. is found. The presence of some form of this Wren was therefore to be expected in the Bogotá region and I was not surprised when Mr. Cherrie secured a specimen of an obvious representative of *æquatorialis* at an altitude of 10,000 ft. in the mountains twelve miles east of Bogotá above Chipaque.

When, however, we discovered through a native collector, that there was a second form of *Cistothorus* in the Suba Marshes on the Savanna of Bogotá, four miles from the city, there was reason for surprise, not only at the occurrence of two forms of this group within a few miles of each other, but that the Savanna species had previously escaped local collectors, or, at any rate, ornithologists.

After purchasing two native-made skins collected in the Suba Marshes January 13, 1913, in February, of that year, we took a city hack as the quickest means of transport, and drove to this locality. The season, however, had advanced and large areas which a month before had been marsh were now dry. We did not therefore succeed in finding additional specimens of *Cistothorus* but did collect the types of *Ixobrychus exilis bogotensis* and *Agelaius icterocephalus bogotensis!*

While measurements alone showed these immature birds to differ from any described form of *Cistothorus,* it was deemed advisable to secure, if possible, adult examples before attempting to characterize the species. To this end the coöperation of Hermano Apolinar Maria, Director of the Instituto de la Salle of Bogotá, was enlisted and thanks to him three adult birds in fresh (postnuptial?) plumage were taken in the Suba Marshes February 7, 1914, and forwarded to the American Museum. It therefore gives me much pleasure to dedicate this interesting species to Brother Apolinar not only as a mark of our appreciation of his assistance on this and on other occasions, but also in recognition of the important service he is rendering science as Director of the Instituto de la Salle of Bogotá.

It is to be noted that *æquatorialis* inhabits the upper life zone, or páramo, above timberline. In the Central Andes we have not found this species below 10,000 feet. Our single specimen from the Bogotá region was taken at the last-named altitude, here at the junction of the Temperate with the Paramo or Alpine Zone. The Bogotá Savanna with an altitude of about 8600 ft. is in the Temperate Zone, and the bird here described is therefore evidently a zonal representative of the *æquatorialis* group, and appears to be isolated on the Savanna. This fact, in connection with its strongly marked characters and the occurrence of *æquatorialis* in the zone above and distant but a few miles, indicates, in my mind, the segregation and specific distinctness of the Savanna bird. In fact, *apolinari* more nearly resembles in color specimens from the Central Andes than it does the specimen taken above Chipaque. The latter is more cinnamomeus above, has the dorsal stripes narrower and browner, and the underparts, including the throat, more heavily washed with rich cinnamon-buff. A topotypical specimen from Pichincha (June 1, 1913) is much like those from Valle de las Pappas and Santa Isabel in the Central Andes, but another from Chimborazo (July 1, 1913) is almost as richly colored as the Chipaque bird. Additional material is required to determine the status of this as well as the Central Andean form but of the distinctness of the Bogotá Savanna bird there seems to be no doubt.

Cistothorus platensis meridæ Hellm. (Bull. B. O. C., XIX, 1907, p. 74) taken at an altitude of 3000 meters in the mountains of Merida, is unknown to

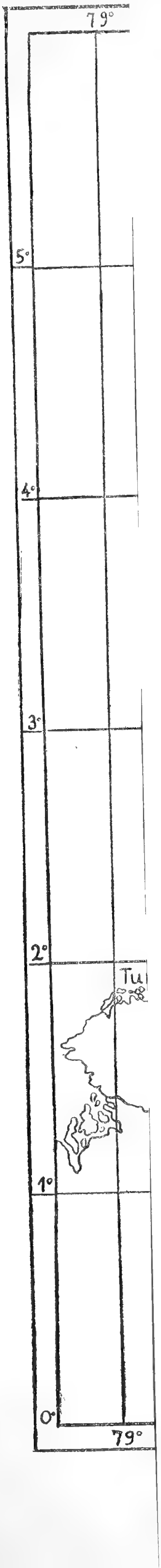
me. It is described as having the side and under tail-coverts with "numerous narrow but very distinct, blackish crossbars," the wing measures 48, the tail 35 mm., and these characters, in connection with others, show that it has no close relation to *apolinari.*

The measurements given below clearly reveal the comparatively large size of *apolinari.* The disproportionately greater width of the wing-quills is indicated by the measurement across the second primary, taken at the end of the outer primary.

Measurements.

Locality	Sex	Wing	Tail	Tarsus	Middle Toe and Claw	Culmen	Breadth Second Primary
Bogotá, Col.[1]	ad.	55	46	23	16.5	13.3	7 mm.
" "	ad.	55	46.5	24	17.5	13	7.5
" "	ad.	56	47	24	16.3	13.3	7.3
Chipaque," [2]	♀ ad.	48	41	19.5	14	11	5
Valle de las Pappas, Col.	♂ ad.	51	46	20.5	14.5	13	5.5
" " " " "	♂ ad.	49	46	19.5	14	13	5.3
Pichincha, Ecuador	♂ ad.	48	44	19.5	14.5	13	5.5
Chimborazo, "	♂ ad.	48	44	20	13	12	5.5

[1] *Cistothorus apolinari* (type).
[2] *Cistothorus æquatorialis.*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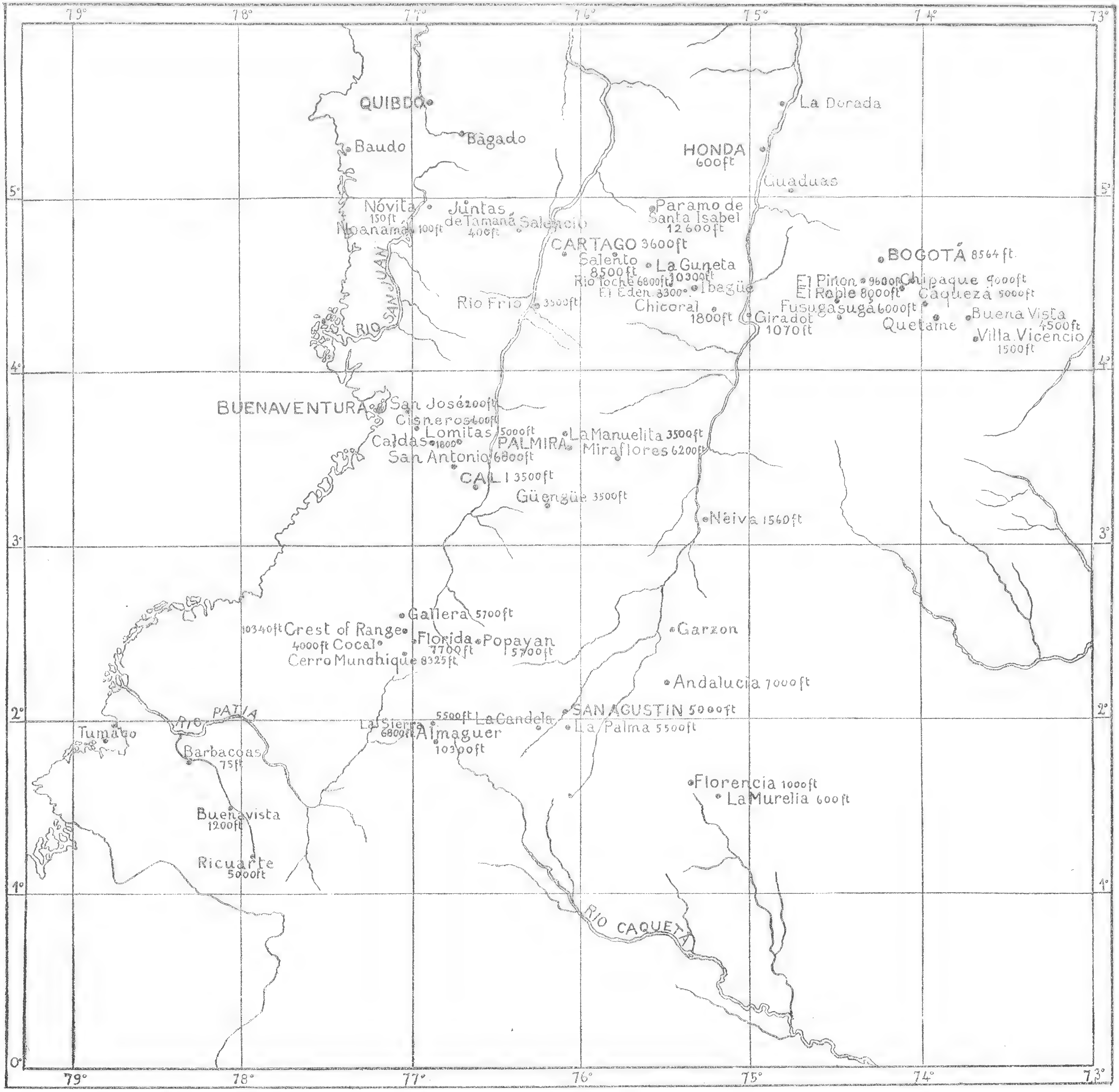
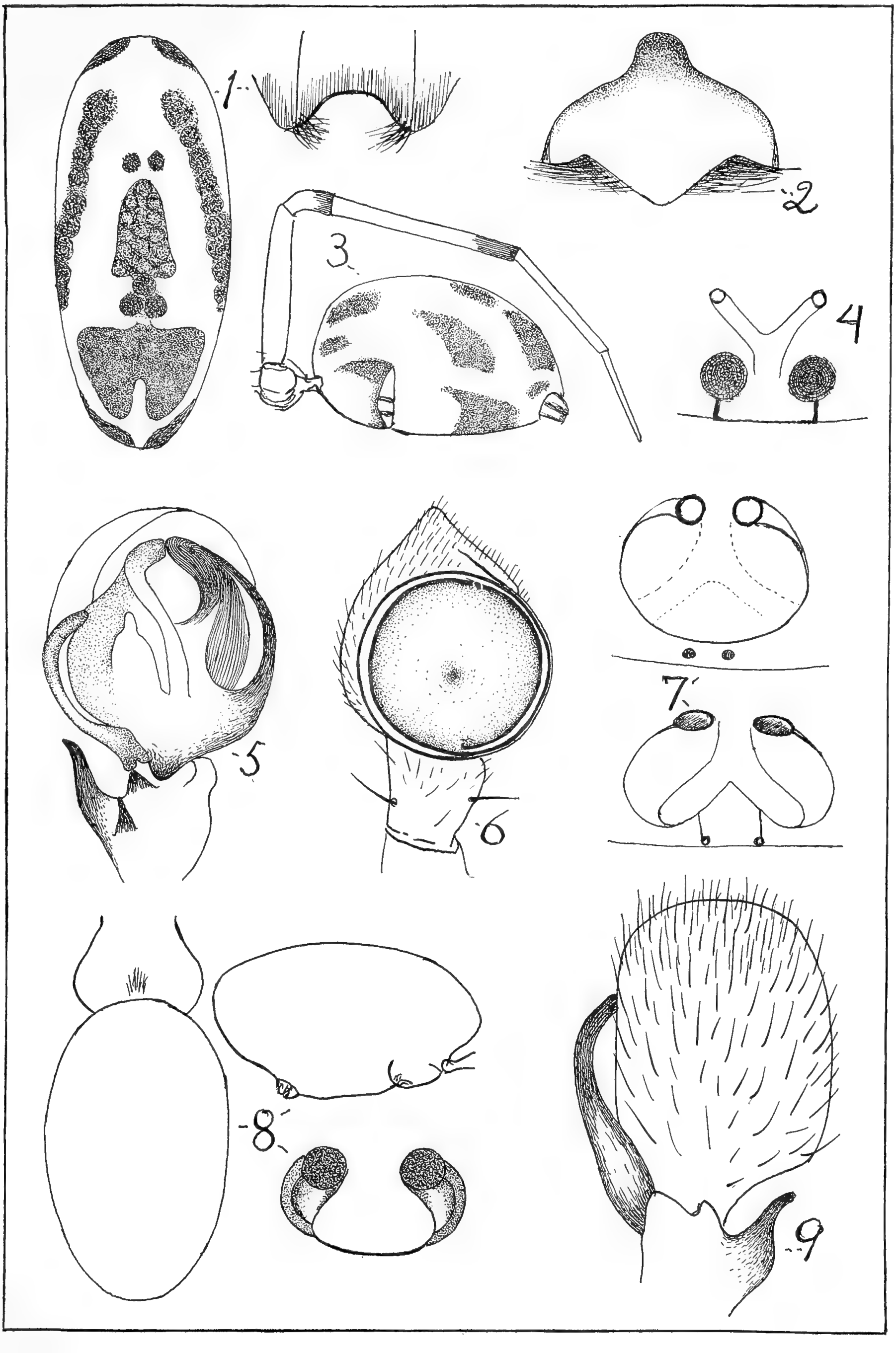


SKETCH-MAP OF SOUTHWESTERN COLOMBIA SHOWING LOCALITIES VISITED BY AMERICAN MUSEUM EXPEDITIONS.



NEW WEST INDIAN SPIDERS.

59.54.4(729)

Article XLI.— NEW WEST INDIAN SPIDERS.

By Nathan Banks.

The following new species were found in the course of an examination of material in the American Museum of Natural History collected by Dr. F. E. Lutz and Mr. Charles W. Leng in Cuba and by Dr. Lutz in Porto Rico. The types are in that institution.

Mecolœsthus signatus n. sp.

Cephalothorax pale, with black median mark, wider at head; sternum reddish or yellowish. Abdomen pale, with a black median stripe, narrowed near middle, not reaching anterior end where there is an oblique stripe, and a basal spot each side, also an apical spot each side, and the basal pleura show an oblique dark stripe. These marks are made up of small spots, more or less connected. The venter shows a narrow, median black stripe followed by a round spot, some distance before the spinnerets. Femora reddish, blackish near tip, and a white band at extreme tip; tibiæ dark, with a broad, white band near tip; rest of legs paler. Eyes in two groups, three each side (subequal in size) on a distinct elevation; A. M. E. minute, close together, and as high as upper edge of A. S. E. Abdomen elongate, cylindrical, spinnerets apical; legs very long; vulval area corneous, yellow, concave behind, but little swollen. Length; ceph. 1 mm.; abdomen 2.5 mm.; femur I, 12 mm.; femur IV, 10 mm.

From Naguabo, Porto Rico, March. No. 21669, Dept. Inv. Zoölogy.

Callilepsis grisea n. sp.

Cephalothorax reddish brown, clothed with white hair; black in eye-region; mandibles reddish brown; legs yellowish, darker on anterior tarsi and metatarsi, a dark band on middle of tibiæ III and IV and these metatarsi rather dark; sternum yellowish brown, darker on sides; abdomen grayish white above and below, above with a median basal blackish streak, a dark streak on each anterior pleuron and a dark streak each side toward apex, and two blackish spots above spinnerets, latter brownish. Cephalothorax narrow; eye-rows short and far apart; P. M. E. slightly oval, about three diameters apart and much closer to the larger P. S. E.; legs moderately long, very hairy or bristly, and with stout spines especially on femora III and IV; tibiæ I and II with three spines beneath, one at base, one at middle, one at tip, metatarsi with basal spine only; metatarsi and tarsi scopulate beneath; hind legs more numerously spined; sternum once and a half longer than broad, pointed behind, narrowed in front; abdomen fully twice as long as broad, sides subparallel. Length 6.8 mm.

From $12\frac{1}{2}$ kilometers south of Pinar del Rio, Cuba, September. No. 21670, Dept. Inv. Zoölogy.

Wulfila pretiosa n. sp.

Pale yellowish. Cephalothorax with a greenish stripe each side, a greenish mark over groove, and two faint lines back from P. M. E.; mandibles with a greenish vertical line in middle. Abdomen with dark greenish or nearly blackish stripe each side reaching to middle, a spot behind it, and a large median spot above spinnerets, four small dark dots in mid-dorsum; legs with faint dark spots at bases of many spines on femora and tibiæ. Cephalothorax narrow in front, A. M. E. hardly more than diameter apart; about as close to the very much larger A. S. E. Posterior eye-row nearly straight, the eyes equal and as large as A. S. E., P. M. E. about two diameters apart, and about as far from P. S. E. Legs long and slender, first and fourth pair about equal, all with stout spines on femora; tibiæ and metatarsi I and II each with two pairs of very long spines, none at tips. The black hair on tips of maxillæ, lip and mandibles is very prominent. Abdomen twice as long as broad. Length 4.5 mm.; leg I, 8 mm.

From San Carlos Est., Guantanamo, Cuba. October. No. 21671, Dept. Inv. Zoölogy.

Wulfila immaculata n. sp.

White or pale yellowish throughout, unmarked; the eyes on black rings, the claws black, and the anterior edge of the vulva reddish. The A. M. E. small, but little more than their diameter apart, about twice as far from the plainly large A. S. E., P. M. E. nearly three diameters apart, and only about two diameters from the P. S. E. Mandibles with only fine hairs; legs long, and very slender, the first pair more than twice as long as the body, all with very long, slender spines, and fine hairs. Abdomen nearly twice as long as broad; vulva shows two reddish marks in front, and behind is a large indistinct cavity. Length 3 mm.; leg I, 7. 5 mm.

Type from 7 kilometers north of Viñales, Cuba, September, No. 21687, Dept. Inv. Zoölogy. Paratypes from Cabanas, Cuba, September; Naguabo, Porto Rico, March; and Mona Island, Feb. Nos. 21672 and 21682 to 21686, Dept. Inv. Zoölogy.

Bathyphantes semicincta n. sp.

Cephalothorax dull yellowish, a marginal dark seam, eyes on black spots; mandibles dull yellowish. Legs pale yellowish, femora and coxæ more whitish, tibiæ and patellæ I and IV tipped with black. Sternum yellowish, margined with dark. Abdomen above gray, with scattered white spots and larger black patches; a basal black spot each side, and two others each side toward tip, the last larger and extending down on sides to near the spinnerets; a large, oblique, dark spot on pleura, and one near base; venter with a large, median blackish spot, concave in front, dark on sides of genital groove. Legs I and II very long, much longer than others, all with many long, fine but stiff, hairs and some erect bristles on tibiæ, a long one at top of each patella above and one near middle of tibia above. Length 1.8 mm.

From 7 kilometers north of Vinales, Cuba, September. No. 21673, Dept. Inv. Zoölogy.

Epeira gundlachi n. sp.

Cephalothorax, legs, sternum, mandibles, and palpi whitish; tarsi, and sometimes metatarsi, slightly infuscated; sternum sometimes more yellowish, no markings. Abdomen white above and below. Eyes small; posterior row recurved, subequal in size, the P. M. E. one half nearer to each other than to the S. E. and about three diameters apart; the four M. E. make a square; A. S. E. smaller than other eyes, close to P. S. E., fully as far from A. M. E. as these from each other. Legs with many fine white bristles, and a few black spines, two on inner side of femur I near tip, no spines in front nor below on femora, nor below on tibiæ I and II, a few above on tibiæ and patellæ, the tarsus plus metatarsus I about as long as tibia plus patella I. Sternum sub-triangular, a little longer than broad, pointed behind. Abdomen fully one and a half times longer than broad, roundedly projecting behind the spinnerets, no higher at base than at spinnerets, and broadest at about middle of length. Length 3 mm.

From 12½ kilometers south of Pinar del Rio, Cuba. September. No. 21674, Dept. Inv. Zoölogy. Related to group of *E. mormon* and *E. peckhami* by shape of abdomen and vulva.

Misumessus echinatus n. sp.

Male: Cephalothorax yellowish, with about fifty small reddish-brown spots scattered over surface, from each of which arises a short, but very stout spine; the marginal seam is reddish. The legs are pale with spots similar to those on the cephalothorax, many of which have a bristle or spine; no marks on the tarsi, but tibiæ and metatarsis are twice banded with reddish. The coxæ and sternum are pale. The abdomen is rather whitish above, with two rows of five reddish spots near middle, and elsewhere with many reddish dots, from many of which arise short, stout spines like those on the cephalothorax, pleura with red spots; venter with two reddish marks near base, beyond genital furrow with transverse white and black spots; some red around the pale spinnerets. The A. S. E. rather larger than usual; P. M. E. about three diameters apart, about as close to the P. S. E. Legs long and slender, tibia I with four pairs of spines beneath, the longest but little longer than the width of the joint. The male palpal organs show a very long stylet curved over two times around the bulb. Length 2.5 mm.

From Cerro Cabras, near Pinar del Rio, Cuba. September. No. 21675, Dept. Inv. Zoölogy.

Olios bicolor n. sp.

Male: Cephalothorax, palpi, sternum, and most of legs yellowish; abdomen dark brown; metatarsi dark, tibiæ infuscated; mandibles reddish brown; tips of male palpi dark. Cephalothorax with several dark lines; a median one reaching to groove, a short one from each P. M. E., one from S. E. curved and then extending toward groove, four or six lateral dark lines; two dark lines on mandibles. A. M. E. rather more than diameter apart, about as far from the somewhat smaller A. S. E.; P. S. E. equal to A. S. E., P. M. E. much smaller than A. M. E., fully two and one half diameters apart and as far from the slightly larger P. S. E. Male palpi figured. Length 10 mm.; ceph., 4.6 mm.; femur I, 5 mm.; tibia I, 3.7 mm.

Type from Desecheo Is., Feb., No. 21688, Dept. Inv. Zoölogy. Paratypes from San Juan, Porto Rico, February; Desecheo Isl., Feb., and Mona Isl., Feb. Nos. 21676 to 21681, Dept. Inv. Zoölogy.

EXPLANATION OF PLATE.

Fig. 1. Mecolœsthus signatus, abdomen and vulva.
" 2. Callilepsis grisea, vulva.
" 3. Bathyphantes semicincta, side of abdomen.
" 4. Wulfila pretiosa, vulva.
" 5. Olios bicolor, palpus beneath.
" 6 Misumessus echinatus, palpus.
" 7. Wulfila immaculata, vulvæ of two specimens.
" 8. Epeira gundlachi, top and side outline of abdomen, and vulva.
" 9. Olios bicolor, palpus above.

59.9.82

Article XLII.— THE GENERA *ŒDIPOMIDAS* AND *SENIOCEBUS*.

By D. G. Elliot, D. Sc., F. R. S. E.

The material available in the various Museums of the World of the genera *Œdipomidas* and *Seniocebus* has always been scanty and insufficient for a satisfactory examination, or for reaching a definite decision. Usually one or two examples of a species, generally more or less poorly mounted, old and faded, represented the various accepted forms in most museums. Lately, however, in collections received by the American Museum of Natural History a considerable number of examples belonging to these two genera have been received from various parts of South America, a careful study of which has made a review of these various species and their synonymy desirable. The Tamarins have been divided into four groups, viz. the two genera under discussion with *Cercopithecus* and *Leontocebus*. The members of *Œdipomidas* and *Seniocebus* are distinguished from those of the other two genera by having a considerable part of the head bare when adult, the young having this portion of the head covered by very short hairs which gradually disappear. While this character would seem to separate these four genera into two divisions, a further investigation of the material now available, would seem to show that the bare head would naturally unite those species of *Œdipomidas* and *Seniocebus*, the characters that remain either externally or in the crania not being of sufficient importance to keep them separated, and therefore it would be better to unite these two genera under *Œdipomidas*, the older name, reducing *Seniocebus* to a synonym. The genus and species with their synonymy as shown by the present material would be as follows.

Genus **Œdipomidas.**

Œdipomidas Reichenb., Vollst. Naturg. Affen, 1862, p. 5, pl. 11, figs. 18–20. Type *Simia œdipus* Linnæus.

Œdipus Less., Spec. Mamm., 1840, pp. 184, 197–200 (nec Tschudi 1838 Amphib.).

Seniocebus Gray, Cat. Monkeys, Lemurs and Fruit-eating Bats, Brit. Mus., 1870, p. 68.

Tamarin Gray, Cat. Monkeys. Lemurs and Fruit-eating Bats, Brit. Mus., 1870, p. 68.

Front of head naked, sometimes also sides of neck; head in one species crested, mainly from occipital region; others with hair from nape long, but head not crested.

Key to the species.

A. Head or frontal portion bald.
  a. Head crested . . . . *Œ. œdipus.*
  b. Head not crested.
    a′. Nape burnt umber . . . . *Œ. geoffroyi.*
    b′. Nape white . . . . *Œ. bicolor.*
    c′. Nape black . . . . *Œ. martinsi.*
    d′. Nape brownish-gray . . . . *Œ. leucopus.*

Œdipomidas œdipus (*Linnæus*).

Simia œdipus Linn., Syst. Nat., 1, 1758, p. 28.
Callithrix œdipus Erxl., Syst. Reg. Anim., 1777, p. 59.
Midas œdipus E. Geoff., Ann. Mus. Hist. Nat., XIX, 1812, p. 122.
Iacchus œdipus E. Geoff., Cours Hist. Nat. Mamm, 1828, p. 36, 10me Leçon.
Œdipus titi Less., Spec. Mamm., 1840, p. 197.
Hapale œdipus Wagn., Schreb. Säugth. Suppl., 1, 1840, p. 251.
Œdipomidas œdipus Reichenb., Vollst. Naturg. Affen, 1862, p. 5, figs. 18–20; Elliot, Rev. Primates, 1, 1913, p. 233.
Leontopithecus œdipus Thos., Proc. Zool. Soc. Lond., 1911, p. 127.
Seniocebus meticulosus Elliot, Bull. Am. Mus. Nat. Hist., N. Y., 1912, p. 31; *ibid.*, Rev. Primates, 1, 1913, p. 188, pl. I.

Type locality. "In America."
Geogr. Distr. Northern Colombia, South America.
For descriptions of this species in fresh adult pelage, see *S. meticulosus* in Review of the Primates, p. 188, Vol. 1, and pl. 1, frontispiece.

Œdipomidas geoffroyi (*Pucheran*).

Hapale geoffroyi Pucher., Rev. Mag. Zool., 1845, p. 336.
Midas œdipus var. Spix, Simiar. et Vespert. Bras., 1823, p. 30. pl. XXIII.
Midas geoffroyi I. Geoff., Cat. Primates, 1851, p. 63.
Midas spixi Reichenb., Vollstand. Naturg. Affen, 1862, fig. 2.
Œdipus geoffroyi Gray, Cat. Monkeys, Lemurs and Fruit-eating Bats, Brit. Mus., 1870, p. 65.
Œdipomidas geoffroyi Reichenb., Vollst. Naturg. Affen, 1862, p. 5. Elliot, Rev. Primates, 1, 1913, p. 234.
Œdipomidas salaquiensis, Elliot, Bull. Am. Mus. Nat. Hist., 1912, p. 137; *ibid.*, Rev. Primates, 1, 1913. Appendix, p. 255.

Type locality. Panama. Type in Paris Museum.
Geogr. Distr. Costa Rica, Central America; Colombia, South America.
Additional material from Colombia seem to show that the characters

for distinguishing *O. salaquensis* are not reliable, the yellowness of the under parts having been produced by staining, and the size of the skull is an individual variation.

Œdipomidas bicolor (*Spix*).

Midas bicolor SPIX, Sim. et Vespert. Bras., 1823, p. 30, pl. XXIV.
Hapale bicolor WAGN. Schreb. Säugth. Suppl., 1, 1840, p. 251.
Marikina bicolor REICHENB., Vollst. Naturg. Affen, 1862, p. 11, fig. 33.
Seniocebus bicolor GRAY, Cat. Monkeys, Lemurs and Fruit-eating Bats, Brit. Mus., 1870, p. 68; ELLIOT, Rev. Primates, 1, 1913, p. 186.

Type locality. Rio Negro, Brazil.
Geogr. Distr. Eastern bank of the Rio Negro, Brazil; Upper Amazon west of Barras; Pebas.

Œdipomidas martinsi (*Thomas*).

Leontocebus martinsi THOS., Ann. Mag. Nat. Hist., 1812, 8th. Ser., XI, p. 84.
Seniocebus martinsi ELLIOT, Rev. Primates, 1, 1913, p. 189.

Type locality. Faro, Lower Yamundá River, Brazil.
Geogr. Distr. Unknown.

Œdipomidas leucopus (*Günther*).

Hapale leucopus GUNTH., Proc. Zool. Soc. Lond., 1876, p. 743.
Callithrix leucopus ELLIOT, Rev. Primates, 1, 1913, p. 222.
Œdipomidas pegasis ELLIOT, Bull. Am. Mus. Nat. Hist., XXXII, 1913, p. 251.

Type locality. Medellen, Province of Antioquia, Colombia.
Geogr. Distr. Colombia, South America.
Additional material received confirms the position of this species as rightfully included in the present genus and also that *Œ. pegasis* is not separable from *Hapale leucopus* Günther.

59.9,82(8)

Article XLIII.— NEW SOUTH AMERICAN MONKEYS.

By J. A. Allen.

In attempting to determine the large number of Monkeys (about 150 specimens) received at the American Museum from South America during the last four years, the following nine forms have been found which appear not to have been hitherto described.

The revision in this connection of our large collection of neotropical monkeys has been greatly facilitated by the recent publication of Dr. D. G. Elliot's 'Review of the Primates,' in which for the first time the scattered, voluminous literature of the subject has been carefully collated and exhaustively cited. The author of 'The Primates' has earned the deep gratitude of all future workers in this field, who will long profit by the years of arduous work he so persistently and conscientiously devoted to its preparation.

Callicebus lugens duida subsp. nov.

Type, No. 36179,[1] ♂ ad., base of Mount Duida (altitude 700 feet), Venezuela, March 25, 1913; Leo E. Miller.

Similar to typical *lugens*, but hands yellow instead of white, white throat patch more or less strongly tinged with yellow, and back, especially anteriorly, with the black more or less suffused basally with brown, often giving a rufous brown tone to the surface.

Type, total length, 780 mm.; head and body, 340; tail vertebræ, 440; hind foot, 95. Four adults (type and 3 paratypes), total length, 765 (748–780); head and body, 345 (338–350); hind foot, 90 (85–95).

Skull (type), total length, 66; occipitonasal length, 60; basal length, 48; zygomatic breadth, 46; orbital breadth, 39.3; postorbital breadth, 33; breadth of braincase, 38; length of nasals, 10; maxillary toothrow, 15. Four adult skulls (type and paratypes), total length, 64.4 (64–66); occipitonasal length, 59 (58–60); zygomatic breadth, 43.7 (42–46); orbital breadth, 38.5 (37.5–39.3); postorbital breadth, 33.2 (31–33); breadth of braincase, 36.4 (35–38); length of nasals, 11.2 (10–12); maxillary toothrow, 15.2 (15–16).

Represented by 6 specimens, 5 adults and 1 quarter-grown young, all from the type locality. In several of the adults the throat is yellowish white. In the young

[1] The collector's numbers on the skulls were lost before the specimens reached the Museum. As these Duida specimens are the only specimens of *Callicebus* thus far collected on any of our South American expeditions, there is no doubt that they belong to the Duida skins. Furthermore, the specimen selected as the type skin is the largest of the series, and the skull is the largest of the skulls, so that both undoubtedly belonged to the same individual. The other skulls are assignable with some certainty on the basis of differences in size or age.

one it is clear white; the hands also are paler than in the adults, and the extreme tips of many of the hairs on the back are bright red. The dorsal pelage in the adults has a more or less rufous tone basally, which in strong light imparts a faint rufous tinge to the surface, from the nape to the middle of the back, more noticeable in some specimens than in others. In a dull light they all appear black.

The type locality of *Callicebus lugens* (Humboldt) is "les forêts qui avoisinet le Cassiquiare et le Rio Guaviaré, près de San Fernando de Atabapo." The mission of San Fernando, where Humboldt spent considerable time, may be taken therefore as the type locality. This mission is about 150 miles west of Duida on the Orinoco River. The type locality of E. Geoffroy's *Callithrix amictus* is unknown ("le Brésil?"). It was secured, with much other South American material, by E. Geoffroy on his visit to Lisbon in 1808, and hence probably came from Brazil, then a Portuguese colony. The type was still extant in the Paris Museum in 1851, according to I. Geoffroy's 'Catalogue méthodique de la Collection des Mammifères,' etc., of the Muséum d'Histoire naturelle of Paris, where it is thus recorded (p. 40): "♂ Type de l'espèce. Du voyage de M. Geoffroy Saint-Hilaire en Portugal en 1808." It is thus not likely to have come from the Upper Orinoco region of Venezuela. Yet the Duida specimens seem to agree well with the description of the type of *C. amictus;* but there may be a yellow-handed black *Callicebus* in some part of Brazil, for which the name should be reserved. It is therefore thought best to give a provisional name to the Duida form. It is also possible that *lugens* may not always have white hands, a point to be yet decided. At present very few specimens of the *lugens-amictus* group have reached museums.

Alouatta seniculus bogotensis subsp. nov.

Type, No. 36476, ♂ ad., Subia (altitude about 7000 feet), Cundinamarca, Colombia (about 25 miles west of Bogota), July 25, 1913; Manuel Gonzales.

Similar in coloration to *A. s. caucensis* but head, nape, limbs, tail and underparts much lighter red, and the back orange red instead of yellow; tail mostly bright red, darker proximally; facial portion of skull much narrower.

Total length (type), 1100 mm.; head and body, 540, tail vertebræ, 660; hind foot, 370. Two adult female topotypes, total length, 1080, 1050; head and body, 530, 530; tail vertebræ, 550, 520; hind foot, 370, 350.

Skull (type), total length, 110; occipitonasal length, 100; basal length, 103; zygomatic breadth, 76; orbital breadth, 61; interorbital breadth, 11.5; postorbital breadth, 40; breadth of braincase, 51; nasals, 24 × 12, maxillary toothrow, 34.5. Two female topotypes, total length, 105, 104; occipitonasal length, 92, 87; zygomatic breadth, —, 53; interorbital breadth, 10, 9; orbital breadth, 61.5, 60; postorbital breadth, 44, 40; breadth of braincase, —, 47; nasals, 19 × 10, 21 × 8.5; maxillary toothrow, 33, 33.5.

Represented by five specimens, 3 skins with skulls, from the type locality, and two flat skins from "Bogota," the former collected by Manuel Gonzales. A single specimen from the Paramo de Rosas, Venezuela, apparently is referable to the same form, being much nearer this than to either *ursinus* or *macconnelli*. A single specimen from the southern base of Mt. Duida also closely resembles *bogotensis*.

In coloration this form is nearest to *A. s. caucensis*, from which it differs in the lighter red color of the limbs, head, and shoulders, and the darker or more reddish color of the back. The cranial differences, however, are much more important than the differences in color. In *bogotensis* the skull is relatively much longer and narrower throughout, both the zygomatic and orbital breadth being 5 mm. less in the male and 3 mm. less in the female than in strictly comparable skulls of *caucensis*, and there is a corresponding difference in the relative length of the skull in the two forms, *bogotensis* having much the longer skull in proportion to its breadth. But the most striking difference is in the facial region, which is greatly compressed in *bogotensis* as compared with *caucensis;* the breadth of the rostrum at the base of the canines is much less, and the nasals are narrower and longer, and in meeting form a much higher and more sharply angular ridge.

In this connection it is necessary to consider two earlier names for red howlers from "Colombia." The first is *Stentor chrysuros* I. Geoffroy (Mém. du Mus. d'Hist. nat. Paris, XVII, 1828 (1829), pp. 166, 171; Guérin's Mag. de Zool., 1832, Cl. I, pl. 7, text and colored plate), described from three specimens collected by M. Plée and believed to have come from "la vallée de la Madeleine." On geographical grounds they would seem referable to *Alouatta seniculus* (Linn.), the type locality of which is Cartagena, Colombia. Comparison is made by Geoffroy with "*Stentor seniculus*," but his specimens of *seniculus*, as he states, were from Guiana, as his comparison also shows, and hence with what is now known as *Alouatta seniculus macconnelli*. His principal character of *chrysuros* was the color of the tail, the apical half of which was "d'un fauve doré très brillant," like the color of the back, present in two of his three specimens and less pronounced in the third. As is well known, the color of the tail in the red howlers varies from red to yellow in specimens from the same localities, so that the alleged character obviously has no value. It seems best therefore to consider *chrysuros* as a synonym of typical *seniculus*, where it has usually been placed.

The second name is *Mycetes laniger* J. E. Gray (Ann. and Mag. Nat. Hist., XVI, p. 219, Oct. 1845), from "Colombia," and "purchased at Paris." As the description is inadequate for the identification of the species, and there is no definite type locality, the species is indeterminable without examination of the type, presumably extant in the British Museum.

Alouatta seniculus caquetensis subsp. nov.

Type, No. 33882, ♀ ad., La Murelia (altitude 600 feet), Caquetá district, Colombia, July 18, 1912; Leo E. Miller.

Color of head, nape, shoulders, limbs, and tail dark chestnut red; back with the hair tips red, a little lighter than the limbs, the basal portion of the hairs with a broad median band of dull ochraceous, the extreme base tawny brown; pectoral region nearly naked; lower abdomen the color of the limbs. Another specimen, a young adult female, is similar but the coloration is still darker. The skulls of these specimens, through loss of the field numbers, cannot be positively correlated with the skins, but the skulls which, on the basis of exclusion, seem to belong to them present no features of distinctive value.

Total length (type), 110 mm.; head and body, 510; tail vertebræ, 590; hind foot, 135.

This form differs strongly in coloration from *A. s. caucensis* of the southern part of the Eastern Andes, represented by specimens from San Agustin (alt. 5000 ft.), and from *A. s. macconnelli* of the Lower Orinoco and Guiana, the two forms geographically nearest; it strongly resembles, however, the dark form of the northern coast of Venezuela (*A. s. ursinus*), from which it is widely separated not only geographically but by intervening forms of an entirely different phase of coloration.

Pithecia milleri sp. nov.

Type, No. 33876, ♂ ad., La Murelia (altitude 700 feet), head of Rio Fragua, Caquetá district, Colombia, July 8, 1912; collected by Leo E. Miller, for whom the species is named.

Upperparts, limbs and tail black, the hairs with long pale yellowish white tips; face sparsely clothed with short whitish hairs; front half of head mars brown, the hairs short and coarse; underparts thinly haired, fore neck naked; hairs dark brown with whitish tips on the throat and belly and with yellowish brown tips over the pectoral region; hands yellowish white, feet whitish grizzled with black.

Total length (type, measured from skin), 880 mm.; head and body, 480; tail vertebræ, 400; hind foot, 120. Skull, total length, 82.7; occipitonasal length, 75.7; basal length, 63; zygomatic breadth, 57; orbital breadth, 43.2; postorbital breadth, 35; breadth of braincase, 43.7; breadth of rostrum at canines, 26; palatal length, 25; breadth of palate at m^1, 14; nasals, 16×15; maxillary toothrow, 19.6.

A young male topotype is similar in coloration but smaller, being not full-grown.

Resembles *P. monachus* in coloration and in character of pelage, but the forehead is dull brown, forming a transverse band, instead of forehead and crown white as in *monachus;* it is, however, smaller with a relatively much shorter tail; skull much smaller.

Cacajao roosevelti sp. nov.

Type, No. 36906, ♂ ad., Baron Melgaço, Matto Grosso, head of the Rio Gy-Paraná, March, 4, 1914; Leo E. Miller, Roosevelt Expedition. Named in honor of Colonel Theodore Roosevelt.

Uniform black throughout, except that upon close inspection in good light the hairs of the whole dorsal region are seen to be slightly tipped with pale buff, giving a faint buffy tone to the black of the dorsal surface. Pelage fine, silky and very long, forming an overhanging mantle along the sides of the body, and a heavy fringe on the outer edge of the limbs and sides of the tail.

Total length, 2 males, type and topotype; type, 850 mm., topotype 630; head and body, 470, 430; tail vertebræ, 380, 400; hind foot, 135, 130; ear from crown, 28, 28. The type is an old male, the topotype a young adult male.

Skull, type and topotype: total length, type, 87, topotype, 85; occipitonasal length, 76, 75; basal length, 64, 60; zygomatic breadth, 60.5, 58; orbital breadth, 46.6, 45.5; postorbital breadth, 39, 40; interorbital breadth, 5, 5; breadth of braincase, 51.5, 49.5; breadth of rostrum at canines, 28, 26; palatal length, 28, 27.5; breadth of palate at m^1, 15, 15; nasals, 17×10, 18×9; maxillary toothrow, 19, 18.

In addition to the type and topotype (skins with skulls), Mr. Miller obtained a skull of an old male taken a day's journey (about 40 miles) below the type locality. This skull (occipital region broken), is more heavily ossified, and probably much older, than either of the others, and is about one millimeter larger in the principal measurements.

Cacajao roosevelti may be easily recognized by its nearly uniform black color, large size, and relatively long tail, the tail being half the total length, instead of one third, or less than one third, as in the other species of the genus. The type locality of the species is far from the hitherto recorded range of the genus. That it is not simply a melanism would seem to be assured by the fact that Mr. Miller took the two specimens from a large troop, all of which were black like those collected.

This species is named in honor of Colonel Theodore Roosevelt in appreciation of the important services rendered by him to science and to the American Museum of Natural History through his recent Expedition to South America.

Ateles longimembris sp. nov.

Type, No. 36909, ♀ ad. Baron Mulgaço, Matto Grosso, head of Rio Gy-Paraná, March 6, 1914; Leo E. Miller (Roosevelt Expedition).

Entire pelage intense dull black; face, hands and feet black. Tail and limbs excessively long, the tail length very nearly twice the length of head and body. Facial portion of skull narrow in proportion to the length of the skull; rostrum relatively narrow and long.

Type (collector's measurements), total length, 1403 mm.; head and body, 488;

tail vertebræ, 915; hind foot, 200. An old male topotype is slightly larger, with, however, the same proportions, as follows: Total length, 1500; head and body, 500; tail vertebræ, 1000; hind foot, 190.

Skull (type and topotype), total length (type), 116, (topotype), 125.5; occipitonasal length, 100, 106.5; basal length, 86, —; zygomatic breadth, 62, 74; orbital breadth, 55, 62; interorbital breadth, 8, 10; postorbital breadth, 45.3, 49; breadth of braincase, 57, 62; breadth of rostrum at canines, 27, 34; nasals, 21 × 11.5, 23 × 17; palatal length, 32, 39; palatal breadth at m^1, 18, 19; maxillary toothrow, 27, 26.

The skull of the male topotype is very old and heavily ossified, and the region in front of the orbits is roughened and the bone porous from disease, as often happens in menagerie specimens but rarely in wild animals. The female has therefore been selected as the type.

In comparison with *Ateles robustus* of the Western Andes of Colombia, the great length of tail and limbs is striking, the tail being relatively about twice as long as in *robustus*, while the limbs are proportionately elongated. The type skull, in comparison with a skull of the same sex and age, and of the same general size of *robustus*, has the orbital region strikingly broader (about 5 mm.), and the palatal region correspondingly wider (about 3 mm.). The rostrum is 4 mm. shorter (measured from the front edge of orbital fossa), and the interorbital breadth nearly one fourth greater.

Unfortunately satisfactory material for comparison with *Ateles ater* (type locality, Guiana) is not at present available. Several specimens presumably true *ater* are without definite localities, but are probably from the Lower Amazon or Guiana. They differ from *longimembris* in having the tail and limbs relatively much shorter, the tail averaging only about as long as the head and body, and the limbs are correspondingly shorter than in *longimembris*, the proportions being not far different from those of *A. robustus*. The single skull of *ater*, however, is more like the type skull of *longimembris* than like that of *robustus*.

The few measurements available in the literature of *Ateles ater* bear out the above alleged differences between *ater* and *longimembris*. The type locality of *A. longimembris* extends the known range of what may be called the *Ateles ater* group far to the southward of any previous records.

Ateles robustus sp. nov.

Ateles ater Allen, Bull. Amer. Mus. Nat. Hist., XXXI, p. 95, April 19, 1912 (Gallera, Colombia).

Type, No. 32354, ♂ ad., Gallera, altitude 5000 feet, Western Andes, Colombia, July 13, 1911; Leo E. Miller.

Entire pelage, face, hands, and feet intense black. Limbs and tail relatively short; skull relatively broad, in comparison with *Ateles ater*.

Collector's measurements, total length, 1220 mm.; head and body, 590; tail vertebræ, 630; hind foot, c. u., 160. Two topotypes, total length, ♂ 1150, ♀ 1260; head and body, 550, 510; tail vertebræ, 600, 750; hind foot, 160, 160.

Skull, type, total length, 112; occipitonasal length, 97; basal length, 76; zygomatic breadth, 73.6; orbital breadth, 61; interorbital breadth, 8.5; postorbital breadth, 45.3; breadth of braincase, 60; breadth of rostrum at canines, 28.6; nasals, 19 × 10; palatal length, 35; breadth of palate at m^1, 20; maxillary toothrow, 26. Three specimens, type and 2 topotypes (2 ♂♂, 1 ♀); total length, 112, 112, 115; occipitonasal length, 97, 96, 99; zygomatic breadth, 73; 69, 67; orbital breadth, 61, 61, 59; interorbital breadth, 8.5, 8.2, 9; postorbital breadth, 45.3, 44, 47.5; breadth of braincase, 60, 57, 62; breadth of rostrum at canines, 28.6, 28, 27.5; palatal length, 35, 35, 34; breadth of palate at m^1, 20, 20, 20.5; nasals, 19 × 10, 20 × 10.5, 20 × 10.5; maxillary toothrow, 26, 27, 25.

A young specimen, apparently about two or three weeks old, is colored entirely like the adults.

This is a short-limbed, heavy-bodied, broad-skulled form, with thick and long glossy black pelage. The tail is only a little longer than the head and body. The average total length of three adults is 1210 mm.; average length of the tail, 660 mm. The skull is broad in proportion to the length, especially the palatal and rostral portions.

Comparison of *A. robustus* has already been made with *A. longimembris*, and incidentally with *A. ater*, from both of which it differs in the broad form of the anterior half of the skull. Both differ from a skull, presumably of *ater*, in the greater posterior extension of the palate of the latter, in which it extends quite beyond the last molar, while in both *robustus* and *longimembris* it terminates on a line with the front border of m^2.

Cebus apella brunneus subsp. nov.

Type, No. 32052, ♂ ad. Aroa (Pueblo Nuevo), altitude 730 feet, Bolivar Railway, Venezuela, Dec. 14, 1911; M. A. Carriker, Jr.

Pelage very thick and long. General color of upperparts (type) hazel, darker along the middle of the back than on the sides, the hairs dusky at base, passing gradually through a broad zone of chestnut into blackish with long hazel tips; face and sides of head pale yellowish gray; top of head with a broad V-shaped crown patch of lengthened blackish hairs, about 50 mm. long and 50 mm. broad on the posterior border, narrowing to a point in front, from which a narrow black line runs forward to the nose; chin and lower part of cheeks whitish (clear white, grayish white, or fulvous white in different specimens); underparts thinly haired, blackish brown, the tips of the hairs hazel; throat lighter than chest and belly; upper arms from shoulders to elbow pale yellowish (about "maize yellow") to the base of the hairs; fore arms, externally, hairs blackish for most of their length with long yellowish tips; internally much darker; hands blackish with light tips to the hairs proximally; hind limbs nearly like the upperparts, but lighter on the outside of thighs; hind feet nearly black, the hairs with hazel tips proximally; tail colored nearly like the back but with a

tendency to a lighter median area above, due to the lighter tips of the hairs (exceptionally with a lighter median area below). The series of 12 specimens varies considerably individually in the intensity of the rufous tone on the upperparts, which is sometimes paler and more yellowish than in the type, which, however, fairly represents the average of the adults. A young adult from Cristobal Colon, Venezuela, is also referable to this form.

Total length (type, collector's measurements), 860 mm.; head and body, 420; tail vertebræ, 440; hind foot, 125. Four adult males (type and paratypes), total length, 882 (860–697); head and body, 423 (420–432); tail vertebræ, 130 (125–135). Three adult females (topotypes), 815 (811–890); 388 (351–418); 452 (425–472); 122 (120–124).

Skull (type), total length, 97; basal length, 66; zygomatic breadth, 68; orbital breadth, 58; interorbital breadth, 6; postorbital breadth, 40, 5; breadth at canines, 28; breadth of braincase, 53; nasals, 18 × 11; palatal length, 31; palatal breadth at m^1, 19.5; maxillary toothrow, 23. Adult female topotype, total length, 92; basal length, 60; zygomatic breadth, 4.3; postorbital breadth, 42.5; breadth at canines, 25; breadth of braincase, 55; nasals, 19 × 10, palatal length, 30; palatal breadth at m^1, 17.6; maxillary toothrow, 22.

Cebus apella brunneus most nearly resembles *C.* [*apella*] *apiculatus* Elliot, from the Lower Orinoco, but has the hair-tips rufous instead of fulvous, the two contrasting strongly when compared in series (12 specimens of each are available for direct comparison), although one specimen in the *apiculatus* series is as richly colored as any in the *brunneus* series. Each series presents a considerable range of variation in both color and the texture of the pelage, but it proves on careful examination to be due mainly to difference in the age of the specimens. True *apella* from Guiana is much darker and less suffused with fulvous or rufous than either *apiculatus* or *brunneus*.

Cebus æquatorialis sp. nov.

Type, No. 34273, ♀ ad., Manavi (near sea-level), Ecuador, Jan. 17, 1913; Wm. B. Richardson.

Upperparts, from nape posteriorly, pale cinnamon rufous, darker along the midline of the back; front and sides of head pale yellowish white; a narrow black transverse line on the forehead, from which a narrow median black line descends to the nose, and an indistinct blackish line runs from the posterior border of the eye to the mouth; limbs externally like the body; hands and feet a little darker (more brownish) than the arms and legs; ventral surface a little paler than the flanks, the chest lighter than the belly; tail above dull wood-brown, darker than the body; under surface of tail much paler than the upper.

Total length (type, measured from the skin), 840 mm.; head and body, 445; tail vertebræ, 395; hind foot, 124. Adult male (from skin), total length, 930; head and body, 480; tail vertebræ, 450; hind foot, 130.

Skull, adult male and female (type), total length, 97, 88.3; basal length, 67, 60; zygomatic breadth, 68, —; orbital breadth, 58, 49; interorbital breadth, 6.2, 4;

postorbital breadth, 41, 38.6; breadth at canines, 28.5, 23.5; breadth of braincase, 53, 50; palatal length, 33, 29; palatal breadth at m^1, 19.2, 18; nasals, 18 × 11, 13 × 8.6; maxillary toothrow, 23.4, 21.

Represented by 4 adults (2 males, 2 females) and 1 young (half grown), all from Manavi, Ecuador. They are all very uniform in coloration except one old male, which is darker and less rufous than any of the others. Hence one of the females has been selected as the type.

Cebus æquatorialis appears to more resemble *Cebus unicolor* Spix than any other described species, the type locality of which is Egá, at the mouth of the Rio Teffé, Brazil, and thus too far from the arid coast region of Ecuador for the two forms to be very closely related.

A single specimen (an old male in faded worn pelage) from Gualea (alt. 7000 ft.) seems to be also referable to *C. æquatorialis,* although at first sight it looks quite different, but the paler coloration is doubtless due to the wearing and fading of the pelage, the Gualea specimen having been taken in July and the others in January.

INDEX TO VOLUME XXXIII.[1]

New names of genera, subgenera, species, and subspecies are printed in **heavy-faced type**, also the main references in a series of references.

[1] Article XXX (pp. 391–493), 'A Preliminary List of the Coleoptera of the West Indies,' by Charles W. Leng and Andrew J. Mutchler, has its own index (pp. 482–493), and therefore is not reindexed in the Index to the Volume.

(*Continued from 4th page of cover.*)

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